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UNIVERSITY OF ALBERTA

THE EFFECTS OF PICTURES ON STUDENTS' RECALL ABILILTY OF TEXT INFORMATION

BY

JO-ANNE HEARD

(C)

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION

DEPARTMENT OF SECONDARY EDUCATION

EDMONTON, ALBERTA

(FALL, 1991)

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The Effects of Pictures on Students' Recall Ability of Text Information

submitted by Jo-Anne Heard in partial fulfillment of the requirements for the degree of Master of Education in Secondary Education.

Dr. J. LaFollette

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Dr. F. Ilott

Date: October 11, 1991

Dedication

I dedicate this work to my husband, Eric, and my son, Christopher. Their support and patience enabled me to complete the program.

ABSTRACT

One hundred and twenty six grade seven students participated in a study to compare the effects of print-only, nonredundant, and redundant conditions on students' immediate and delayed recall of central text information. The design was a posttest, analysis of covariance (the covariate was reading comprehension), to test for immediate and delayed achievement differences between the three conditions.

In addition to the in-school study, one basic reference textbook was evaluated in order to determine the degree of content relationship that existed between pictures and text. An evaluation instrument was developed in order to measure the redundancy level between the pictorial and textual content. Based on previous research, the subject, object, and verb of the pictorial and textual content were established as the criteria on which the evaluation instrument was based.

Also, eleven people who were involved in the screening, selection, and/or using of textbooks were interviewed. The purpose of the interviews was to gain insight into the criteria that are used in order to screen and select textbooks that are used in classrooms.

For the in-school study, statistical analysis of the data revealed no significant difference in the immediate recall achievement means or in the delayed recall achievement means among the groups. There was a significant difference resulting from interaction of groups with time. The redundant treatment group achieved a significantly higher mean on the delayed recall test than the other two groups.

The results of the textbook evaluation indicated that the content relationship between pictures and text was low. The pictorial content and the main body text content had only one of the subject, object, and verb in common.

The results of the interviews indicated that the administrators, teachers, and students acknowledged the motivational, explicative, and retentional function of pictures during the screening and using process. Screening and selection personnel did not use a criteria-based instrument to evaluate the potential effectiveness and function of pictures juxtaposed with text. Varying opinions of how pictures interact with text resulted.

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CHAPTER 1: THE PROBLEM AND ITS SETTING

Introduction

The presence of illustrations in educational textbooks can assist the learner in processing and learning information that corresponds to the text. Research has shown a correlation between combining text and pictures and learner achievement, better recall, and comprehension of information (Anglin, 1987; Nugent, 1982; Brody & Legenza, 1980; Levin & Berry, 1980; Haring & Fry, 1979; Peng & Levin, 1979; Levin & Lesgold, 1978).

The degree to which pictures contribute to learning from text information varies. The variation of recall or comprehension achievement by students largely depends on the functional intention for including pictures in textbooks.

> "...one reason for the proliferation of intuitive design practices is the lack of clear understanding as to how images and prose function interactively. In an attempt to explicate this relationship, Duchastel (1978, 1980) has posited three categories of images, defined by their functional relationship to prose -- motivational, explicative, and retentional" (Bernard, Petersen & Ally, 1981, p.107).

The function of motivational pictures may not be to render or reinforce text information to which they are juxtaposed. Motivational pictures may be included

simply to enhance interest and reader enjoyment. Therefore, the value of motivational pictures for specific topical learning would be minimal. Although the motivational value of pictures cannot be totally dismissed, research has primarily concentrated on the explicative and retentional value of pictures in improving students' recall of text information. The consistent findings in the studies are that text plus pictures, when compared with text only, significantly improves recall of sentence information.

The researchers cited above have mainly concentrated on the explicative nature of pictures. The function of explicative pictures is to explain, clarify, and detail information of the text to which they are related. The results of studies (Nugent, 1982; Brody & Legenza, 1980) indicated that short-term memory and recall increases if text information is accompanied by explicative pictures.

The function of retentional pictures is to increase memory and retention of the meaning of the text to which they are related. Research evidence also supports the value of pictures for committing text information to long-term memory. Two studies concluded that long-term memory and recall of text information

improves if pictures accompany text (Anglin, 1986; Anglin, 1987).

A number of research studies (Wood, Pressley, Turnure & Walton, 1987; Anglin, 1986; Digdon, Pressley & Levin, 1985; Pressley, Pigott, Levin, LeComte & Hope, 1983; Nugent, 1982; Pressley, Pigott & Bryant, 1982; Levin, Bender & Pressley, 1979) have examined the significance of redundancy between picture and text content in illustrated books. The authors of such studies sought to determine whether or not recall increased under picture-text redundancy conditions when compared with picture-text nonredundancy conditions. The results of these studies revealed that better recall occurred if there was redundancy between picture and text content.

Previous research supported that redundancy is present when the exact content, i.e. subject, object, and verb, of the sentence is also conveyed in a picture(s). For example, redundancy would exist if the sentence read, "The family of five sat around the dining room table," and the picture illustrated five family members sitting around a dining room table. Nonredundancy is present when the picture content does not match the sentence content. For example,

nonredundancy would exist if the sentence read, "The family of five sat around the dining room table," and the picture illustrated a house in a residential area.

There are many degrees which exist between redundancy and nonredundancy of pictures and text. The method of assessing redundancy between pictures and text, i.e. identifying the subject, object, and verb as the content components on which a level of redundancy is described is not widely used. However, previous research utilized the subject, object, and verb in the conditions for their studies (Levin, Bender, & Pressley, 1979; Pressley, Pigott & Bryant, 1982). A redundancy scale was developed, based on criteria implemented by previous research, and will be fully described in the methodology section.

It is important to explain the relationship between redundancy and the motivational, explicative, retentional triad as the very essence of this study pertains to this relationship. In the context of picture research, redundancy refers to the content similarities between pictures and text information. The motivational, explicative, retentional triad refers to the function of picture-text relationships as it affects learning behavior in students. The degree to which information will be clarified and remembered will

be affected by the content relationship between pictures and text information.

After reviewing a considerable number of studies on the redundancy versus nonredundancy issue, it was discovered that the subjects used represented either early elementary students or university students. Few research studies, however, were conducted at the secondary school level. In view of the results of research studies favouring redundant relationships between pictures and text, and the deficiency of samples studied at the junior high or high school level, the following question was developed for the purpose of this research study: **Do grade seven students recall more information under redundant or nonredundant text-picture conditions?**

The nature and focus of this study pertains to the explicative and retentional value of pictures explored through redundant and nonredundant text-picture relationships. In other words, can the function of pictures serve to explain, clarify, and detail text information to which they are matched (explicative and/or redundant)? Do matched pictures and sentences improve the students' memory of information (retentional and/or redundant)?

Pictures are incorporated into educational textbooks in all subject areas and across all grade levels. Duchastel (1980) supports the inclusion of pictures in textbooks in saying:

> "That illustrations can assist learning, in terms of comprehension and recall, has been demonstrated in a number of studies -- and that is all that is needed to substantiate a continued belief in their value in textbook design" (Duchastel, 1980, p.285).

In view of previous research results, and as a preliminary component of this study, it was necessary to examine the redundancy versus nonredundancy status of picture-text relationships in an educational textbook currently being used in our schools. Three important sub-questions were addressed.

1) To what extent is the text content and the picture content redundant in a basic reference textbook prescribed by Alberta Education?

2) How do three variations of picture-text redundancy relationships affect students' recall of text information.

3) Do textbook-selection personnel consider the function of pictures and their relationship to text information in the selection process?

These are the questions which this study explored in conjunction with the main research question.

The contributions that this study makes to the body of knowledge associated with educational media research are (a) an understanding of the redundancy

status of a textbook as applied to a newly created scale based on previous research criteria, (b) an understanding of the criteria used by textbook selection personnel, and (c) further school-based research evidence taken from a sample at the secondary level to add to the research already done on the picture-text redundancy versus nonredundancy issue.

Purpose and Hypotheses

Based on results of previous research that has been done examining the effect of picture-text relationships on students' recall ability, the following predictive hypothesis was developed:

> The groups exposed to the redundant picture and text condition will achieve significantly higher scores on the posttest and delayed recall test compared with the remaining groups that are exposed to nonredundant picture-text and print-only conditions.

In order to analyze the data, the following null hypotheses were developed:

Hypothesis 1: There will be no significant difference in the immediate recall of the text information among the groups based on achievement means of the posttest.

Hypothesis 2: There will be no significant difference in the delayed recall of the text information among the groups based on the posttest.

Hypothesis 3: There will be no significant difference resulting from interaction of groups with time.

The fact that previous research has examined the effects of pictures on facilitating recall of information at the early elementary or postsecondary level, indicated that there was a need to test students at the secondary level.

For the most part, the research studies which are cited in forthcoming sections developed materials for the experiments from sources other than course-related materials. However, Brody (1981) contends that the "development of meaningful results is made more difficult by the use of pictorial illustrations not representative of those found in instructional texts" (1981, p.95). This researcher felt that it was important to evaluate and test an illustrated textbook that was course-relevant and aimed at a particular level of audience to which the textbook is suited.

Limitations

The following limitations of this study may affect the degree to which the results might be generalized to a larger population and are a threat to the external validity of the experiment.

1. Only one textbook was evaluated for the status of the content-relationship between pictures and text. The basic reference textbook evaluated was published in 1986. This publication may not be representative of the current publications that have been approved by the province.

2. The size of the sample for the interviews was relatively small. The personnel were all selected from the same city and may not be representative of textbook screening, selection, and user personnel of the larger population.

3. The sample for the in-school study was not selected at random from the population. The sample was formed from intact classes from three junior high schools.

Delimitations

1. The textbook evaluation addressed a single grade seven social studies basic reference resource. The study did not attempt to evaluate supplementary resources or resources from subject areas other than social studies.

2. The interviews were restricted to personnel who were involved in the screening, selection, and direct using of educational textbooks. The study did not attempt to include personnel from the publishing industry.

3. The testing for the in-school study was restricted to measuring differences of immediate and delayed recall achievement between print-only, nonredundant, and redundant conditions.

4. The in-school study was restricted to social studies classes at the grade seven level.

5. Only the representational classification of pictures were utilized in the stimulus for the in-school study (see definitions for analogical and arbitrary illustrations in the "Definition of Terms").

Definition of Terms

Analogical Pictures. A picture that depicts a concept or topic by showing something else and suggesting a similarity, i.e. a picture of a human eye to illustrate the aperture opening of a camera.

Arbitrary Pictures. A highly schematized picture that does not look like the object or thing it is supposed to represent, i.e. a road map of Edmonton.

Explicative Pictures. The function of illustrations which compliment the printed word for the purpose of explaining, clarifying, and detailing information of the prose to which they are related.

Iconic Code. A set of symbolic codes that depict an external, perceptual representation of information that is relatively concrete in nature, i.e. pictures.

Linguistic Code. Information that is structured from words related to a particular language, i.e. written text and audio are linguistically based systems.

Motivational Picture. The function of illustrations which compliment print for the purpose of reader enjoyment and personal interest.

Nonredundant. Pictures which illustrate something other than the sentence information, i.e. the subject, object, and verb of the sentence does not relate to the picture. E.g. Sentence: "The woman put the letter in the mailbox". The corresponding picture would show a man sitting on the sofa.

Picture. Representation of something on a two-dimensional surface, i.e. drawing, painting, photograph, maps, diagrams.

Recall. To call or bring back to mind information to which a person has already been exposed.

Redundant. Pictures which illustrate the exact content, i.e. subject, object, and verb, of the sentence information. The word redundancy is also synonymous with information overlap, matched, and elaborate pictures. E.g. Sentence: "The woman put the letter in the mailbox." The corresponding picture would illustrate a woman putting a letter in a mailbox.

Representational Pictures. A picture that physically resembles a thing or concept that it stands for, i.e. a picture of a teapot to represent a teapot.

Retentional Pictures. The function of illustrations which complement printed words for the purpose of increasing memory and retention of the prose to which they are related.

CHAPTER 2: REVIEW OF RELATED LITERATURE

Introduction

The presence of illustrations in educational textbooks can assist the learner in processing and learning information that corresponds to text. Research has shown a correlation between combining print with pictures and learner achievement, better recall, and comprehension of information (Nugent, 1982; Brody & Legenza, 1980; Levin & Berry, 1980; Haring & Fry, 1979); Peng & Levin, 1979; Levin & Lesgold, 1978).

The degree to which different pictures contribute to learning from text information varies. The variation of recall or comprehension achievement by students largely depends on the functional intention for including pictures in textbooks. According to Bernard, Petersen & Ally (1981), there seems to be little understanding of how images and prose function interactively. They attribute intuitive design practices to this lack of understanding of the interaction between images and prose.

There are numerous factors which may determine the educational effectiveness of a picture when it is combined with text, i.e. pictorial attributes -- colour, realism, location; redundancy, instructional

purpose, and learner characteristics. A number of research studies (Wood, Pressley, Turnure & Walton, 1987; Anglin, 1986; Digdon, Pressley & Levin, 1985; Pressley, Levin, Pigott, LeComte & Hope, 1983; Nugent, 1982; Pressley, Pigott & Bryant, 1982; Levin, Bender, & Pressley, 1979) have examined the significance of redundancy between picture and text content in illustrated textbooks.

The studies sought to determine whether or not recall increased under text-picture redundancy conditions when compared with text-picture nonredundancy conditions. The results of these studies revealed that better recall of text information occurred if there was redundancy between pictures and text.

The purpose of this review is to provide an overview of the literature associated with the impact of pictures, combined with text, on student learning and recall. The research literature which addressed the picture-text relationship is grouped into the five following topics:

A. Definitions and Classifications of Pictures
B. Function of Pictures Juxtaposed With Text
C. Symbol Systems and Cognitive Processes

D. Research on Pictorial Attributes: Student Recall of Text Information

E. Research on the Picture-Text Content Relationship: Redundancy Between Pictures and Text

Emphasis will be placed on experimental research in education that dealt primarily with representational pictures found in textbooks. In addition, the notion of learning from written text, i.e. the effect of pictures on student-recall of text information, will be the main thrust and application of the literature to be reviewed.

A. Definitions and Classifications of Pictures

When a person perceives a picture, it becomes a process that begins with observing that a marked surface contains information about something other than itself -- information about the depicted content (Levie, 1987). The viewer will construct a meaning from the picture based on a host of variables, i.e. cultural background, education, attitude, context. A picture's instructional significance can be realized when the picture is in harmony with the cultural and educational background of the student. In addition, the effectiveness of an illustration depends on the instructional cues given to the observer and its relevance to the text information which accompanies the visual.

Instructional pictures are classified on the basis of their structural reality and their relationship with the corresponding text. Three of such classifications are: (i) representational pictures, (ii) analogical pictures, (iii) arbitrary pictures (Alesandrini, 1984; Knowlton, 1966; Gropper, 1963). The significance of the three classifications is to understand how each type of visual may contribute to the learning process. In other words, how do pictures effect learning from sentence information under each classification?

Representational pictures physically resemble a thing or concept that the picture stands for (Alesandrini, 1984). The purpose of including representational pictures is to enhance memory of information by providing visual examples when teaching concepts. Knowlton (1966) uses the word "realistic" to describe the representational classification of picure in saying:

> "...a realistic visual-iconic representation of some object in the visual world is a realistic picture provided that the communicator's intent is to make reference to the type of object portrayed" (Knowlton, 1966, p.176).

Gropper (1963) elaborates on another important dimension of visual representation which he terms as "literalness of representation". He states that verbal propositions may make reference to physical phenomenon, to abstract phenomenon, or to a combination of both.

> "Visuals vary considerably in the extent to which they can parallel or reproduce these verbal referents... Thus the literalness of a given visual example varies depending on its referent" (Gropper, 1963, p.90).

Representational pictures can depict information directly or indirectly. The amount of realistic detail found in visuals would depend on the degree of concreteness or abstractness of the concept being communicated (Wileman, 1980). An object or concept may be directly or indirectly portrayed in a visual. For

example, information naming the parts of a microscope can be concretely depicted in a picture of the microscope. An example of an indirect depiction of a concept in a representational picture would be the notion of poverty. Photographs of certain poverty-stricken areas would help to concretize the concept of poverty.

An issue relating to representational pictures in learning has been whether the amount of detail in the visual determines its effectiveness. Dwyer (1978) defines a realism continuum as extending from the object or situation itself to a simplified illustration.

> "The more qualities a visual has in harmony with the object or situation which it is to denote, the more realistic the visual is said to be" (Dwyer, 1978, p.5).

Dwyer conducted a number of studies which addressed whether or not the amount of realism or detail in a picture affected the degree to which students learned. Dwyer's studies indicated that simple illustrations facilitated better learning than detailed pictures such as photographs. One strength of a highly realistic and complex visual might be that it has interest value. However, highly schematized pictures are often used in place of the realistic

picture. The educational worth of schematized pictures is that unnecessary elements and noncriterial details are eliminated in order to strengthen the learning value.

Analogical pictures differ from representational pictures in their appearance and instructional intent. The analogical picture will depict a concept or topic by showing something else and suggesting a similarity. Knowlton (1966) defines an analogical picture:

> "If the intent is to make reference to something else -- something that is in some way analogous to the portrayed object or to its manner of functioning -- the vehicle is an analogical picture" (Knowlton, 1966, p.176).

For example, the concept of the shutter opening of a camera might be depicted in an illustration of the iris of a human eye. According to some learning theorists (Baddeley, 1975) students will better remember new information (shutter opening) if it is associated with familiar or prior knowledge (the human eye).

Arbitrary pictures are highly schematized visuals that do not look like the object or things they are supposed to represent (Alesandrini, 1984). Gropper (1963) states that the advantage of using arbitrary pictures is:

> "...when shorthand visual representations are desired for referents which may or may not be capable of direct, indirect, or analogous representation" (Gropper, 1963, p.93).

Examples of arbitrary pictures are graphs, flowcharts, maps, charts, and diagrams.

The learning potential for using arbitrary pictures is to illustrate relationships and structure of certain elements. For example, a highway map depicts cities, towns, and highways. The components of the map, i.e. cities and towns, are generally represented by geometric forms, i.e. large circles to stand for cities, smaller circles to stand for towns. The contours of the circle symbols bear no relationship to the actual contour of the city's boundary line. However, it would be much easier for a motorist to follow the highly schematized highway map than an aerial photograph of the same area. Arbitrary pictures are free from nonessential elements and details. This type of picture can assist the student in organizing and focussing attention on important and significant information of the concept being communicated.

B. Functions of Pictures Juxtaposed With Text

Educational textbooks have integrated a variety of types of illustrations into their formats across all subject areas. The value and functions of combining

illustrations and print are numerous. However, not all types of pictures facilitate learning to the same degree. For example, decorative pictures that are not relevant to the text information may not facilitate the same type and degree of learning as text-relevant pictures (Levin, Anglin & Carney, 1987; Brody, 1980b).

The variation of recall or comprehension achievement by students largely depends on the functional intention for producing and including pictures in textbooks (Bernard, Petersen & Ally, 1981; Duchastel, 1978, 1980). Learning and recall achievement is also influenced by the educational objectives and instructional functions of pictures, i.e. the reasons and methods used by an instructor to communicate information (Brody, 1984; Dwyer, 1978).

The picture-text relationship can be evaluated on the basis of the functions they serve in textbooks. Three of such functions are motivational, explicative, and retentional. Motivational pictures' content may not be related to the text information at all and its value for specific topical learning would be minimal. Levin, Anglin & Carney (1987) label the use of text-irrelevant pictures as serving a decoration function. The decoration function (motivational) applies when illustrations are included in textbooks to

make them more attractive in order to (a) increase publishers' sales and (b) to create students' interest in using the textbook.

> "Usually the production of visual illustrations is based on the subjective feelings of the designer about what is best, the accessibility of raw information, the availability of materials, the cost, the attractiveness of the finished product, and the availability of a ready market" (Dwyer, 1972, p.2).

The distinguishing characteristic that classifies a picture as serving only a motivational function is that it has no relationship with the text content.

The function of explicative pictures is to explain, clarify, and detail information of the text to which they are related. Explicative pictures serve to clarify difficult-to-understand text information and abstract concepts. The learner is able to interpret complex information by having access to visual illustrations which are text-relevant (Levin, Anglin & Carney, 1987). The results of studies (Nugent, 1982; Brody & Legenza, 1980) indicate that short-term memory and recall increases if text information is accompanied by explicative pictures.

The function of retentional pictures is to increase memory and retention of the text to which they are related. Information that is coded both in picture

and in words tends to be committed to the learners' memory much easier than information supplied through just one system. Two studies indicated that long-term memory and recall of text information improves if accompanied by related pictures (Anglin, 1987, 1986). The distinguishing characteristic of retentional images is that they reinforce the content of the passage and provide supplementary contextual support (Bernard, Petersen & Ally, 1981).

Although the motivational value of pictures cannot be totally dismissed, the major considerations in assessing the instructional effectiveness of visuals must focus on their explicative and retentional value. Ideally, pictures should serve a motivational, explicative and retentional function.

The instructional functions and, consequently, the learning value of using visual illustrations in textbooks is of concern to researchers involved with picture-text interaction. Duchastel (1980) believes that the traditional reason for including illustrations in books has been to make books more attractive and appealing to students and more marketable for the publisher. The publisher's profits and the motivational value of pictures are practical considerations from a business and aesthetic viewpoint.

However, the potential value of illustrations for improving instruction and learning must be at the forefront of considerations.

A general reason for using illustrations in textbooks is that they clarify the information being presented through instruction (Dwyer, 1972). The motivational, explicative, and retentional function of pictures, to some extent, should be able to:

"1) Facilitate accuracy and standardization of the message being communicated;

2) Bring into the classroom inaccessible processes, events, situations, materials, and phase changes in either space or time;

3) Illustrate, clarify, and reinforce oral and printed communication, quantitative relationships, specific details, abstract concepts, and spatial relationships;

4) Provide concreteness (realistic detail) in the learning situation;

5) Increase student interest, curiosity, and concentration;

6) Present to the learner the opportunity to perceive an object, process, or situation from a variety of vantage points;

7) Provide important instructional feedback." (Dwyer, 1978, p.1)

The functions served by visual illustrations can assist the teacher with planned objectives and content treatment. Dwyer's (1972, 1978) list of the instructional functions that pictures can serve is by

no means complete. However, the list clearly states the contributions that motivational, explicative, and retentional pictures can make to instructional processes and procedures. It is necessary to make decisions about the objectives, content, and reasons for using pictures in any instructional context.

C. Symbol Systems and Cognitive Processes

Pictures and words are derived from symbol characters or coding elements which represent some form of idea or concept from which knowledge can be extracted. Characters or codes have "rules or conventions of combining and arranging them into schemes" (Salomon, 1979, p.29). Formulating a sentence from letters of the English alphabet to represent a concept or idea could be classified as a scheme derived from symbolic coding elements, i.e. letters. Developing an image of a house using coding elements such as line, shape, colour, and texture could be classified as a scheme, i.e. picture.

> "A symbol scheme becomes a symbol system when correlated with a field of reference. This field of reference can then be said to comply with the symbol scheme, or be denoted by it" (Salomon, 1979, p.31).

Examples of symbol systems are music, spoken language, printed language, and painting.

Instructional media possess symbol systems which might promote thinking and problem solving in learner behaviour. Designers of textbooks which contain pictures utilize symbol systems "as ways of abstracting or representing concepts or experiences (symbols) that are tied together with rules or syntax (systems)" (Clark, 1980, p.63). Clark notes that Salomon states that "the important features of symbols for instruction is the extent to which they correspond with our internal representations" (1980, p.63). Instructional media, be it pictures in textbooks, film or slides, should compliment the cognitive processes or internal constructs of the learner.

> "The symbolic system of a medium is a set of symbolic codes that describe the relationship between some aspect of a picture and its internal representation. The elements of a particular symbolic code are (a) type of pictorial cue, (b) the mental imagery this cue evokes, and (c) the mental operations required to make the translation from the pictorial cue to the mental representation" (Levie, 1978, p.28).

It can be said that learning will occur from these symbolic codes if the elements are compatible with the mental constructs and the cognitive processing skills of the learner.

Instruction seeks to affect the learning processes of students in some way. Pictures and text found in textbooks operate externally to the learner. The

learner, in turn, internally processes the information through psychological mechanisms. The cognitive processes are the means through which the student "perceives, assimilates, interprets, stores, and retrieves information" (Winn, 1982, p.4). The mental skills of each learner operate concurrently with externally presented stimuli.

The instructor may show a student a picture of an object that directly corresponds to the reading assignment given to the student the night before. Hopefully, the student will be able to retrieve this internally stored information when the instructor presents an external stimulus such as a picture or a question. Clark states in his discussion of media and cognition that:

> "to extract knowledge from instruction, students must use previously acquired mental skills" (Clark, 1980, p.64).

There are a number of factors which effect comprehension of information from pictures and text combined.

> "Comprehension and subsequent retention may be facilitated by the willingness to invest more time and cognitive effort in studying the reading material, the enhancement or elaboration of semantic processing, the availability of a context and the activation of relevant knowledge enabling a more meaningful interpretation and a more effective storage of the text, the availability of

> an organizing scheme clarifying and representing spatial and structural relationships of elements in the text, and so on" (Peeck, 1987, p.128).

There is an interaction between the symbol systems and cognitive processes which seems to be at the heart of the underlying factors which make pictures in textbooks effective in helping students to acquire information. Learning from pictures and text require that the learner be able to process information through two systems; the verbal symbolic system and the pictorial or iconic system.

D. Research on Pictorial Attributes: Student Recall of Text Information

Dwyer asserts that research must focus on the "isolation, identification, classification, and measurement of those essential stimuli characteristics, used both singly and in various combinations in visual illustrations, which are instrumental in increasing significantly student learning" (Dwyer, 1972, p.3). Brody (1984) supports Dwyer's assertion in saying "to help the picture function appropriately, decisions must be made on numerous pictorial elements including use of color, degree of pictorial complexity, degree of realism, number of noncriterial elements within the picture, use of long-shots or close-ups, etc." (Brody, 1984, p.59).

What are some of the characteristics which make pictures effective in facilitating recall and learning of text information? A number of studies have dealt exclusively with the pictorial attributes which are instrumental in helping students to recall information, i.e. picture placement (location) and use of long-shots versus close-ups (Brody & Legenza, 1980), degrees of realism (Dwyer, 1978), use of colour and number of noncriterial elements (Levin, Bender & Pressley, 1979; Dwyer, 1978), and the degree of pictorial complexity (fidelity) (Digdon, Pressley & Levin, 1985).

Picture placement refers to the relative placement of the visual illustrations to the placement of the printed text information. Brody & Legenza (1980) examined whether or not the location or type of picture affected reading comprehension. The study attempted to determine if incidental learning was affected by: (a) picture location, i.e. placing the picture after rather than before, the reading passage and, (b) close-up versus long-shot pictures, i.e. pictures that depict an overview of an entire scene rather than one that depicts a specific incident mentioned in the corresponding passage.

The results showed that placing the picture after the passage was read as opposed to before the passage

resulted in better recall scores. Post-pictures seem to produce better comprehension of incidental information than do pre-pictures. This study revealed that post-pictures can result in a review process or reinforcement process of text information much in the same way that review questions posed after a reading do. The picture type, i.e. aerial versus close-up, was not a significant variable. In this situation, the specific pictorial attributes were not a significant factor.

Noncriterial elements found in pictures refer to those details which are included in pictures that do not have direct relevance to the prose information. Levin, Bender & Pressley (1979) conducted a study to determine if pictures showing details distract students' attention from central information and, consequently, hinder recall. In addition, the kind of story information likely to be enhanced by real and imagined pictures was studied. The "distracting" details included in the subject/object pictures were colour and facial expressions. These pictorial elements were regarded as peripheral to the story information.

The results indicated that colours were recalled better than facial expressions. The effect of

illustrations was more pronounced on students' recall of central text information than on recall of peripheral text information. The implication of this study is that it is not necessary to include extraneous details, i.e. facial expressions, colour, which are not relevant to the central information contained in the story.

Dwyer (1978) states that the use of colour can be an important instructional variable when it suits the text information and specific educational objectives. He also states that, for other educational objectives and relevance to the text information, the inclusion of colour may not be necessary from an instructional effectiveness perspective.

Digdon, Pressley & Levin (1985) studied the effect of partial and object pictures on students' recall and memory of text information. A partial picture illustrated most, but not all, content of the sentences. An object picture illustrated the specific object missing from the partial picture. A partial and object picture illustrated all of the information contained in the sentence. The text information was read to the preschoolers and, simultaneously, the pictures were shown.

The results indicated that the partial and object picture yielded the highest score on the recall test. This study indicated that superior learning occurs when both partial and object pictorial information is present. The authors stated that memory can be enhanced if prose is accompanied with illustrations which are complete in nature.

The realism continuum (Dwyer, 1978) is another factor which can determine the instructional effectiveness of pictures. Realism is defined as the extent to which the pictorial elements correspond to the actual object or situation being depicted. For example, a simple line drawing of a human heart would be a highly schematized version of the actual object and, therefore, would be classified as low in its realistic depiction. A photograph of a human heart would be classified as high in its realistic detail.

Dwyer examined the effects of the following pictures of the human heart on students' ability to recall information: 1) simple line drawing (low realism), 2) detailed shaded drawing, 3) heart model photographs, 4) realistic heart photographs (high realism). Schematic illustrations (low realism) yielded better recall of text information. The studies revealed that an increase in the degree of realism of

an illustration will not necessarily produce a corresponding increase in the amount of information a student will recall from it.

E. Research on Picture-Text Content Relationship: Redundancy Between Pictures and Text

Textbooks incorporate a linguistic system and an iconic system. It has been posited by researchers (Paivio, 1986; Pressley & Miller, 1987) that if information is presented in both a literal and pictorial code students' memory of such content will increase. Nugent (1982) studied whether presentations by an iconic system (pictures) and/or a linguistic system (print/audio) aid learning. The results indicated that students recalled more information if there was redundancy of information between the systems. Combined systems (e.g. text plus visuals) were found to promote better recall of information than a single system (e.g. print only).

The main concern in this section was to explore research which addressed the effects of text-relevant or redundant pictures on students' ability to recall textual information.

> "By conveying information through both linguistic and iconic symbols, students were provided with complementary processing systems, and they could alternate between the two to obtain information" (Nugent, 1982, p.172).

Research has established that students' recall of text information was improved when picture and text content were completely matched, i.e. redundant (Nugent, 1982; Pressley, Levin, Pigott, LeComte & Hope, 1983; Pressley, Pigott & Bryant, 1982; Digdon, Pressley & Levin, 1985; Levie & Lentz, 1982; Wood, Pressley, Turnure & Walton, 1987; Anglin, 1986; Anglin, 1987). The studies compared matched picture conditions (redundant) with mismatched picture conditions (nonredundant) and no picture conditions.

Pressley, Levin, Pigott, LeComte & Hope (1983) studied the effects of mismatched pictures on children's recall of text information. Matched pictures are those which depict the exact text content. Mismatched pictures are those which depict something different from the text content. The results of the experiment revealed that recall of text content was superior in the matched picture condition.

In later experiments cited in this study, the authors discovered that mismatched pictures had little negative effect on students' recall. This study indicated that, although mismatched pictures did not interfere with student recall, there is a correlation between picture-word redundancy and student achievement on recall tests.

Pressley, Pigott & Bryant (1982) asked the question: Do students remember what they hear when accompanying pictures do not completely overlap the sentence content? This experiment entailed reading the text content to preschoolers as opposed to having the students read the text for themselves. The sensory modality was shifted from seeing to listening to text information. Nonetheless, students were still exposed to dual-coding systems; the digital and the iconic. In two experiments, the students recalled more information from specific sentences when the subjects and objects were depicted in the illustrations. Recall was not as good if the illustration only depicted the subject or the object of the sentence to which it was related. Correct recall in the completely matched condition was superior to the recall in the other conditions.

Levin & Berry (1980) were interested in finding out if prose-relevant pictures could improve children's recall of curriculum-related and nonfictional-passage content. The authors developed pictures that were relevant to newspaper passages to determine whether such pictures would improve students' recall of the passage content. The results of four experiments indicated that fourth-grade students who were exposed to newspaper articles and illustrations combined

remembered more information than children who were just exposed to the articles. The authors concluded that relevant visual illustrations are effective nonfictional prose-learning aids.

The previously cited studies examined the effects of redundant word-picture conditions on young children's, i.e. elementary, short-term recall of information. Anglin (1986, 1987) explored the effects of prose-relevant pictures on older learners' ability to recall information. The added variable to Anglin's studies was whether picture effects are durable over time, i.e. long-term memory. The long-term memory factor is important in that it is more representative of the learning goal to which classroom teachers aspire; that is, to insure that educational experiences are not short-lived (Peng & Levin, 1979).

Anglin (1986) compared the effects of a prose-plus-picture passage at two intervals: (a) immediately after the passage was read and (b) 14 days after the passage was read. Anglin sought to answer the following two questions: "Can positive picture effects found with young children be extended to older learners? If found, are the positive picture effects durable over time?" (Anglin, 1986, p.136). The experiments revealed that recall for prose-plus-picture

condition was 10 percent to 18 percent higher than that of the prose-only condition. In addition, the students who were exposed to the prose-plus-picture condition achieved higher scores in both immediate and delayed testing conditions.

The research studies cited above have helped to confirm that if the relationship between the picture content and the text content are redundant, students' short-term and long-term memory of information will improve. The dual-coding of information through the literal system, i.e. reading passages and listening passages, has not produced a significant change in students' ability to recall information (Nugent, 1982; Peng & Levin, 1979). However, dual-coding between differing systems, i.e. reading or listening to text information (digital system) combined with viewing illustrations (iconic system), seemed to produce a significant increase in students' ability to recall prose information.

The relationship between symbol codes, cognitive processes, pictorial attributes, instructional functions, and text-picture redundancy must be acknowledged in picture research. The research studies described indicated that pictures do facilitate and improve recall of text information.

CHAPTER 3: RESEARCH METHODOLOGY

Introduction

The research question was addressed through three study components. The first study component involved an evaluation of the grade seven social studies textbook, "The Peigan: A Nation in Transition", Bernadette Pard, 1985. The purpose of the textbook evaluation was to (a) develop a redundancy scale that would contribute to clarifying a definition of the varying levels of redundancy as interpreted from previous studies conducted on picture-text relationships and (b) examine the level of redundancy (or nonredundancy) between pictures and text in an Alberta Education prescribed grade seven textbook.

The second study component involved conducting interviews with administrative personnel who were responsible for the selection of textbooks used in secondary schools. The purpose of the interviews was to disclose the criteria that were used to determine which textbooks would be selected for use in schools. In particular, the interviews established whether or not consideration, or the extent thereof, was given to the relationship between pictures and text. In addition, teachers and students opinions on what they deem as important textbook characteristics were sought.

The third study component involved an in-school evaluation of grade seven students' recall differences when exposed to (a) print only, (b) nonredundant, and (c) redundant conditions. The purpose of this component was to determine if there were any mean score achievement differences in students' short-term and/or long-term recall among the three conditions.

The complimentary significance of each study component determined the following:

A. The degree to which there are content similarities between pictorial and textual information in one grade seven basic reference textbook.

B. The extent to which textbook selection personnel, teachers, and students considered the content relationship between pictures and text.

C. The extent to which redundancy between pictures and text affected students' short-term and long-term recall of text information.

One criticism that has been aimed at media research is that content material used in picture-text experiments is removed from that which is used in schools. As a result, the conclusions of research studies are somewhat diluted in significance and have little practical importance (Dwyer, 1972; Brody, 1981). In order to endow this study with practical significance, the textbook evaluation, interviews, and

the in-school study addressed resource(s) that are currently being used in junior high schools.

Details of each study component and corresponding results are as follows:

A. **Textbook Evaluation**

One social studies basic reference text was evaluated to determine the level of redundancy between the pictures and the text content. The reasons that the textbook evaluation was important, and that it preceded the in-school study, are as follows:

1. To develop a scale by which redundancy between picture and text content could be measured,
2. To determine the redundancy status of the textbook from which the in-school study resources was adapted,
3. To base the redundancy degree of the in-school study stimuli on a criterion-based scale.

The textbook evaluated contained five chapters and thirty units. The unit distribution per chapter was as follows:

Chapter 1 - Units 1 and 2
Chapter 2 - Units 3 to 12
Chapter 3 - Units 13 to 20
Chapter 4 - Units 21 to 23
Chapter 5 - Units 24 to 30

One hundred and twenty-eight pictures and ninety two captions were counted and included in the

evaluation. Each chapter had a cover picture. The cover pictures of the five chapters were not considered in the textbook evaluation because their function was clearly to denote a transition from one chapter to the next.

Because picture-text placement was not a variable in this study, the pictures, captions, and body text did not necessarily have to be on the same page in order for it to be assigned a level of "high redundancy". However, the pictures, captions, and body text had to be contained in the same unit.

Three categories of "content-relationships" were evaluated:

1. redundancy status between **pictures and sentence(s) contained in the main body text**
2. redundancy status between **pictures and captions**
3. redundancy status between **captions and sentence(s) contained in the main body text**

Previous research identified the subject, object, and verb of picture and text information as the components that were matched or mismatched in their study conditions. The components of a sentence, subject, object, and verb, were the elements on which the varying levels of the redundancy scale was based. It was assumed that it was possible to draw an analogy

between content components of sentences and pictures. Thus, a sentence from the main body text of a given unit, that corresponded with the subject, object, and verb of the picture and/or caption, was searched for. The process of evaluation was as follows:

A. The picture-text content relationship for each unit was evaluated.

B. Pictures were numbered and titled for identification purposes.

C. Each picture's subject, object, and/or verb was then translated into a sentence.

D. The caption (if present) and a sentence in the main body text was searched for in a given unit. The content of the picture, caption, and/or sentence from the main body text was compared on the extent to which the subject, object, and/or verb matched.

E. A level of redundancy was assigned to each category and based on the following:

5: High	The subject, object, and verb of a sentence completely overlaps with the picture and/or caption content.

e.g. "A man wore the blanket wrapped around his body, leaving his left shoulder covered and his right arm and shoulder uncovered"

The picture and/or caption would depict the exact and complete sentence content.

4: Medium

The subject, object, and verb would be stated in the sentence; only symbols related to the subject and the object would be present in the picture and/or caption.

e.g. "A man wore the blanket wrapped around his body, leaving his left shoulder covered and his right arm and shoulder uncovered."

The picture would depict a man and a blanket. However, the man would not be wearing the blanket (the verb would not be illustrated). Similarly, the caption would state something about a man and a blanket but would exclude the information about how the blanket was worn.

3: Low

The subject, object, and verb would be stated in the sentence; only symbols representing the subject or the object would be present in the picture and/or caption.

e.g. "A man wore the blanket wrapped around his body, leaving his left shoulder covered and his

		right arm and shoulder uncovered." The picture would depict a man or a blanket. The caption would state something about a man or a blanket.
2:	Nonredundant (thematically related)	The subject, object, and verb of the sentence information do not correspond with the picture and/or caption. However, the picture and/or caption is thematically related to the unit heading. e.g. "A man wore the blanket wrapped around his body, leaving his left shoulder covered and his right arm and shoulder uncovered." The picture and/or caption would depict a pair of moccasins. Both the manner in which a man wears a blanket and the pair of moccasins related to clothing worn by the Peigan culture. However, no mention was made of moccasins in the main body text contained in a given unit.
1:	Nonredundant (thematically unrelated)	The subject, object, and verb of the sentence information and chapter do not relate at all to the picture content and/or caption content. e.g. "A man wore the blanket wrapped around his body leaving his left shoulder covered and his right arm shoulder uncovered."

The picture and/or caption would depict a tipi. The tipi does not thematically relate to the sentence or unit content.

The picture's function and the caption's function was classified as highly redundant, i.e. fully explicated the subject, object, and verb of a sentence contained in the main body text, if it rated a "5" based on the aforementioned scale. The second highest rating of "4", medium redundancy, was assigned to the pictures and captions that contained referents of the subject and object or verb of a sentence taken from the main body text. The "3" rating, low redundancy, was assigned to pictures and captions that contained a symbol of one of the subject, object, or verb taken from a sentence in the main body text. The "2" rating was assigned to pictures and captions that did not contain referents of a subject, object, or verb in any sentence within the main body text but did relate to the theme of the unit. The lowest rating of "1" was assigned to pictures and captions that did not contain referents of the subject, object, or verb in any sentence in the main body text; nor was there any relationship between pictures/captions and the theme of the unit.

The data analysis for the textbook evaluation was a quantified study that tested for the degree of content relationship between pictures and captions, and the main body text. The degree of content relationship between pictures and text were recorded on a data collection sheet (Appendix G). The data were developed to illustrate the degree of content relationship between each of the following:

1. picture and main body text (128 relationships)
2. caption and main body text (92 relationships)
3. caption and picture (92 relationships)

The level of redundancy assigned to each of the above relationships was translated into percentages. For example, the results of the "picture and main body text" is broken down into the five levels of redundancy. The percentages illustrate the number of relationships that corresponded with each level.

B. Interviews

The purpose of surveying textbook selection personnel and users of textbooks was to determine what criteria were used when selecting textbooks for classroom use. Specifically, what qualities or characteristics must be present in a textbook in order for it to be selected for classroom use? The ultimate

result of the interviews was to determine if consideration is given to the value and function of pictures, combined with text, in educational textbooks.

The subjects interviewed were as follows:

1. One provincial department representative,
2. One protestant central office administrator representing a city in Alberta,
3. One catholic central office administrators representing a city in Alberta,
4. Two classroom teachers from two different secondary schools (one from the protestant and one from the catholic system) in Alberta.

The people interviewed have served on a selection committee or assumed responsibilities that related to the selection and approval of textbooks for use in secondary schools. In addition, six grade seven students were interviewed in order to gain insight into what students regard as important textbook characteristics and qualities that promote learning.

The instrument used was a standard set of questions. The representative from the provincial department and two central office administrators were asked the same questions. The interview format was slightly modified for the two teachers and the six

students so as to consider language level and their role as "users" of textbooks. Essentially, the interview formats (see Appendix A) maintained a common agenda which was to gain insight into the following:

1. What criteria are used for textbook selection (or, in the case of the students, which qualities and characteristics appealed to them)?
2. What content characteristics are looked for in textbooks selected and/or used?
3. What roles should pictures play in a textbook? (If mentioned as one of the criteria.)
4. What physical qualities should pictures contained in textbooks possess? (If mentioned as one of the criteria.)

The eleven interviews were recorded on audio cassette and then transcribed into print. The analysis of the interview results was divided into two groups and summarized in paragraph format. The two groups were:

1. Textbook screening and selection **administration** personnel at the provincial and district level (one representative from the province, two representatives from two school districts;
2. Textbook screening, selection, and user personnel at the school level (two

teacher/department heads, and six grade seven junior students.

C. In-School Study: Do grade seven students recall more information under redundant or nonredundant text-picture conditions?

The purpose of the in-school study was to compare the explicative and retentional function of representational pictures, juxtaposed with text, under redundant and nonredundant conditions. The explicative function of pictures was revealed in the results of the posttest for each treatment group. The retentional function of pictures was examined by giving the same posttest to the treatment groups two weeks after the passage was read.

Subjects. The subjects were seventh graders from three junior high schools located in a large city. Six intact groups, each consisting of males and females, participated in the study. Average ability groups were selected, i.e. the study did not include classes that were labelled as gifted or low-ability. The students' reading comprehension ability determined by their scores on an achievement test (Canadian Achievement Test), written by the students during their grade six year, was selected to serve as the covariate for the purpose of data analysis. Two intact groups were assigned to each of the three conditions.

Instructional Treatments. The instructional materials were prepared from one grade seven social studies reference text titled "The Peigan: A Nation in Transition" (Pard, 1985). Three instructional treatments were prepared by editing only the pictures that were contained in Unit 11, titled Peigan Clothing. The text information and layout remained identical for the redundancy and nonredundancy conditions. A print-only (control) condition was presented in a slightly different layout, i.e. columns of print without space allocation for pictures. The instructional treatments were as follows:

1. Print only (control group): Paragraphs were read by the subjects. The paragraphs were presented without pictures. (Appendix B)

2. Redundant text-pictures: The same paragraphs that were used in the print only condition were used in the redundant text-picture condition. The paragraphs were accompanied by pictures that completely matched, i.e. contained referents for the subject, object and verb, the central theme sentence(s) contained in each paragraph. The pictures were placed on the same page as the related sentence. For example, the sentence, "A man

wore the blanket wrapped around his body, leaving his left shoulder covered and his right arm and shoulder uncovered" was accompanied by a black and white illustration that depicted a man wearing a blanket wrapped around his body. The man's left shoulder was covered and his right arm and shoulder was uncovered. (Appendix C)

3. Nonredundant text-picture: The same paragraphs that were used in the other two conditions were used in the nonredundant text-picture condition. The number of pictures used in the redundant text-picture condition remained the same for the nonredundant text-picture condition. The paragraphs were accompanied by pictures that do not correspond to the text information. For example, the sentence, "A man wore the blanket wrapped around his body, leaving his left shoulder covered and his right arm and shoulder uncovered" was accompanied by a black and white illustration of a tipi. In accordance with the previously mentioned scale, the text-picture relationship will be

at level 2: Nonredundant (thematically related). (Appendix D)

Stimulus. The reading passage selected was adapted from a grade seven social studies basic reference textbook. The particular unit was selected because of the concrete nature of the theme, Peigan clothing.

The researcher was assisted by two social studies teachers in identifying central sentence information. The print-only passage was given to the two teachers. The teachers were asked to highlight the sentence(s) in each paragraph that they regarded as central or important to the paragraph. The researcher embarked on this process as well. A consensus was reached on identifying what was central to each paragraph. The illustrations were then created to match the central sentence information.

The passage, content, length, and number of pages are identical to the format of the basic reference text material from which the stimulus was adapted. The alterations made for the purpose of the study were the number of pictures, and the content of the pictures. The original source contained six pictures. The redundant and nonredundant treatments contained eight pictures. The alteration to the pictorial content was

made to suit the redundant and nonredundant conditions. Black and white illustrations were used because no reference was made to colour in the central sentence information contained in the body text.

Instrument. The instrument consisted of a 12-question multiple choice recall test based on information presented in the central sentences identified and reiterated in the corresponding illustrations. Identical questions were used for both the immediate recall posttest (Appendix E) and the delayed recall test (Appendix F). However, the order of the multiple choice answers and the order of the questions were changed for the delayed recall test. The change in order between the immediate and delayed recall tests hopefully challenged the students to remember the information from the passages and not the sequence and pattern of multiple choice questions and responses.

Validity/Reliability of Test Instrument. In order to verify the validity and reliability of the test instrument, the following steps were taken:

1. **Identification of significant test information in the reading passage.** Two social studies teachers were asked to read the passage and to identify the primary information contained in each paragraph.

The posttest multiple choice questions were developed from the overall consensus of the two teachers and the researcher.

2. **Reliability**. The reliability coefficient for the sets of scores (immediate recall test and delayed recall test) achieved by each treatment group were calculated. Essentially, the reliability provided insight into the technical quality of the test as it applied to the achievement of the three treatment groups.

The reliability method used was an internal consistency analysis. Formula 21, developed by Kuder-Richardson, abbreviated "K-R21," was used to calculate the test reliability coefficients. Ebel & Frisbie support the relationship between the difficulty of test items and the rationale behind selection of the K-R21 formula: "If the test items do not vary widely in difficulty, a reasonably good approximation of the quantity can be obtained from information about the test mean and the number of items" (Ebel & Frisbie, 1986,

p.78). The K-R21 formula is:

$$r = \frac{k}{k-1}\left[1 - \frac{X(k-X)}{ks^2}\right]$$

r=reliability, k=number of items, X=mean score, s=standard deviation

The reliability coefficients are measured on a scale of 0.00 to 1.00. According to Ebel & Frisbie, "...the achievement tests used in many elementary, secondary, and college classrooms often show reliability coefficients of 0.50 or lower" (Ebel & Frisbie, 1986, p.70).

The mean scores and standard deviations noted on test 1 and test 2 for the three treatment groups were used with the K-R21 formula to obtain the following reliability coefficients:

Accordingly, the reliability coefficients (Table 1) indicated that the instrument was reliable, relative to the 0.50 or lower standard of teacher-made tests, for the print-only group (test 1=.53, test 2=.66); the nonredundant group (test 1=.63, test 2=.74); and the redundant group (test 1=.63, test 2=.39).

The relatively low reliability coefficient of .39 for test 2 of the redundant group was primarily

due to the relatively high mean and small standard deviation.

TABLE 1: Summary of Reliability Coefficients (K-R21)

Treatments	Immediate Recall Test 1	Delayed Recall Test 2
Print-only	.53	.66
Nonredundant	.63	.74
Redundant	.63	.39

One way of increasing the reliability of a test is to include more items. However, given the intent of the study, i.e. to test for achievement differences between the three treatment groups ability to recall and comprehend central information from the passage, more than 12 items would likely have resulted in testing for other than comprehension of central information.

Procedure. After the stimuli was read, the immediate recall test was given to the treatment groups. Students did not have access to the passage while they took the test.

The delayed recall test was given to the treatment groups two weeks after they read the passage. Again, students did not have access to the stimuli while they took the test.

Data Analysis. For the school-based research, the design was a posttest, analysis of covariance (the covariate was reading comprehension), to test for achievement differences, for both the immediate and delayed recall tests, between the three conditions. The analysis of covariance was selected in order to statistically control for anticipated difference resulting from the fact that intact groups were used and the subjects were not randomly selected.

CHAPTER 4: RESULTS

Restatement of Research Purpose

The primary aim of this study was to examine the content relationship between text and pictures, and the degree to which they complimented one another, through a sequence of three study components. Each study component contributed to testing the following predictive hypothesis: **Students' immediate and delayed recall of textual information will be affected by the redundancy status between pictures and text**. The study questions and related objectives were as follows:

1. Textbook evaluation - What is the degree of redundancy between pictures and text in a prescribed basic reference textbook? (To develop and implement a system for assessing the level of redundancy between pictures and text in a prescribed basic reference text.)

2. Interviews - Is content relationship, i.e. redundancy between pictures and text, a criterion that is used by textbook selection /user personnel? (To gain insight into the criteria and perceptions of textbook selection/user personnel as to what

characteristics and elements should be present in textbooks selected for use in schools.)

3. In-school study - Does the degree of redundancy between pictures and text affect students' immediate and/or delayed recall ability? (To examine if there were any achievement differences of grade seven students immediate and delayed recall mean scores between the print-only, nonredundant word-picture, and redundant text-picture conditions.)

Textbook Evaluation

The results of the textbook evaluation reflected the degree to which the content of pictorial and literary elements related to one another in the basic reference textbook, "The Peigan: A Nation in Transition" (Pard, 1985).

The data analysis for textbook evaluation was a quantified study that tested for the level of redundancy: 5=High Redundancy; 4=Medium Redundancy; 3=Low Redundancy; 2=Nonredundancy (thematically related); 1=Nonredundancy (thematically unrelated) for each of the following three relationships:

1. picture and main body text
2. picture and caption
3. caption and main body text

The following descriptions and tables illustrate the results of the level of redundancy for each of the three relationships.

Picture and Main Body Text

There were a total of 128 pictures juxtaposed with body text in the textbook. The evaluation involved finding a sentence that contained the subject, object, and/or verb compatible with each picture within the

boundary of the same unit. A level of redundancy was assigned to each picture-sentence pair on a scale of 5 (high redundancy) to 1 (nonredundancy) and recorded on a data sheet (see Appendix G). The number of picture-sentence pairs, that corresponded with each level on the redundancy scale, were counted and translated into percentages. Figure 1 represents the percentage of picture-sentence pairs that were calculated for each of the five levels on the redundancy scale.

Out of the 128 picture-sentence pairs, the distribution for each level was as follows: 17% of the picture-sentence pairs were at level 5 (high redundancy), 9% of the picture-sentence pairs were at level 4 (medium redundancy), 47% of the picture-sentence pairs were at level 3 (low redundancy), 25% of the picture-sentence pairs were at level 2 (nonredundancy, thematically related), and 2% were at level 1 (nonredundancy, thematically unrelated).

The mean for the picture and main body text relationship was 3.14. The 3.14 mean represents a low redundancy status, based on the redundancy scale, for the picture and main body text relationship.

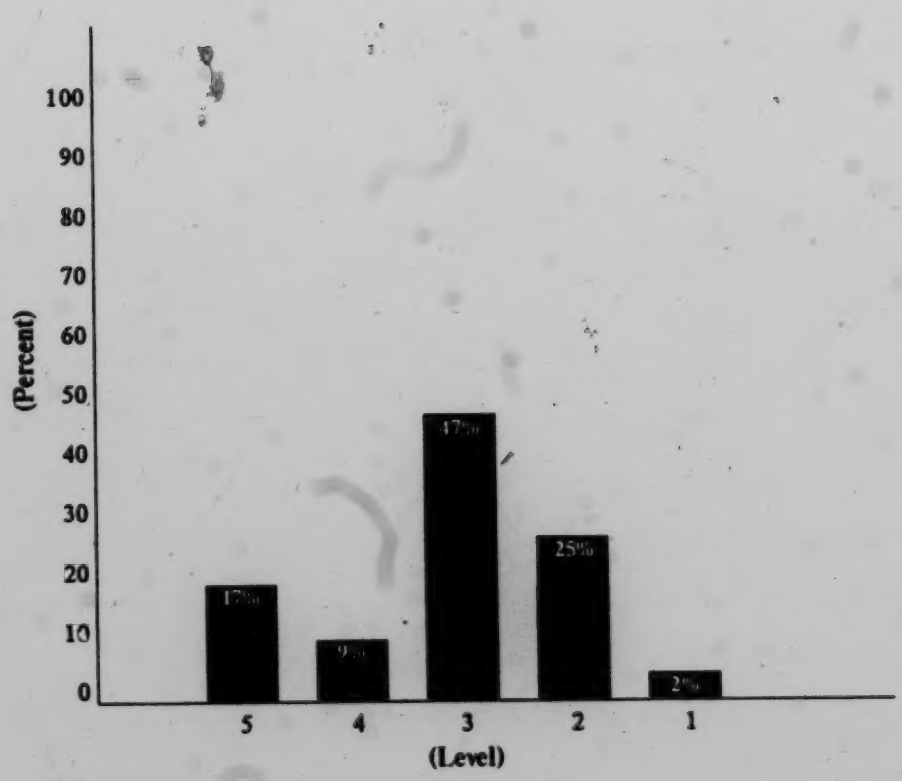

Figure 1. **Content Relationship Status of Picture and Main Body Text**

Essentially, the majority of the picture-sentence pairs had only **one** of the subject, object, or verb in common.

Picture and Caption

The number of captions contained in the textbook was 92. The captions were juxtaposed, i.e. directly under, ontop, or beside, the pictures. Not all of the 128 pictures had captions which accounts for the discrepancy between the number of pictures and the number of captions counted. A level of redundancy was assigned to each caption-picture pair and based on the degree to which the subject, object, and/or verb matched. A level of redundancy was assigned to each picture-caption pair and recorded on the data sheet (see Appendix G). The picture-caption pairs assessed at each level were counted and translated into percentage form. Figure 2 illustrates the results of the redundancy relationship between pictures and captions.

Out of the 92 picture-caption pairs, 70% were evaluated at level 5 (high redundancy), 8% were evaluated at level 4 (medium redundancy), 18% were evaluated at level 3 (low redundancy), 3% were evaluated at level 2 (nonredundant, thematically

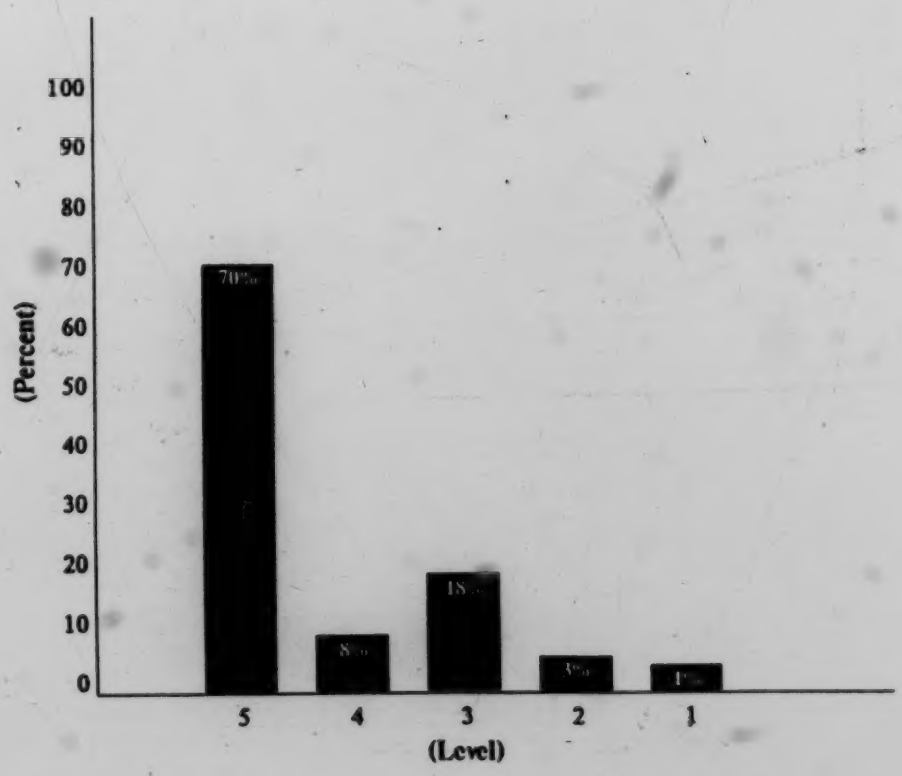

Figure 2. Content Relationship Status of Picture and Caption

related), and 1% was evaluated at level 1 (nonredundant, thematically unrelated).

The mean for the picture-caption relationship was 4.41. The 4.41 mean indicated that the redundancy status of the relationships were at the medium to high redundancy level. Generally, the picture-caption pairs matched in at least two out of the three elements (subject, object and verb).

Caption and Main Body Text

As previously mentioned, the number of captions counted were 92. A sentence that matched, or closely matched each caption, was searched for in the main body text within the boundary of the same unit. A level of redundancy was assigned to each caption-sentence pair and recorded on the data sheet. The number of caption-sentence pairs, that corresponded with each level on the redundancy scale, were counted and translated into percentages. Figure 3 illustrates the redundancy status between the captions and the main body text.

Out of the 92 captions, 15% of the caption-sentence pairs were rated at level 5 (high redundancy), 4% were rated at level 4 (medium redundancy), 50% were rated at level 3 (low

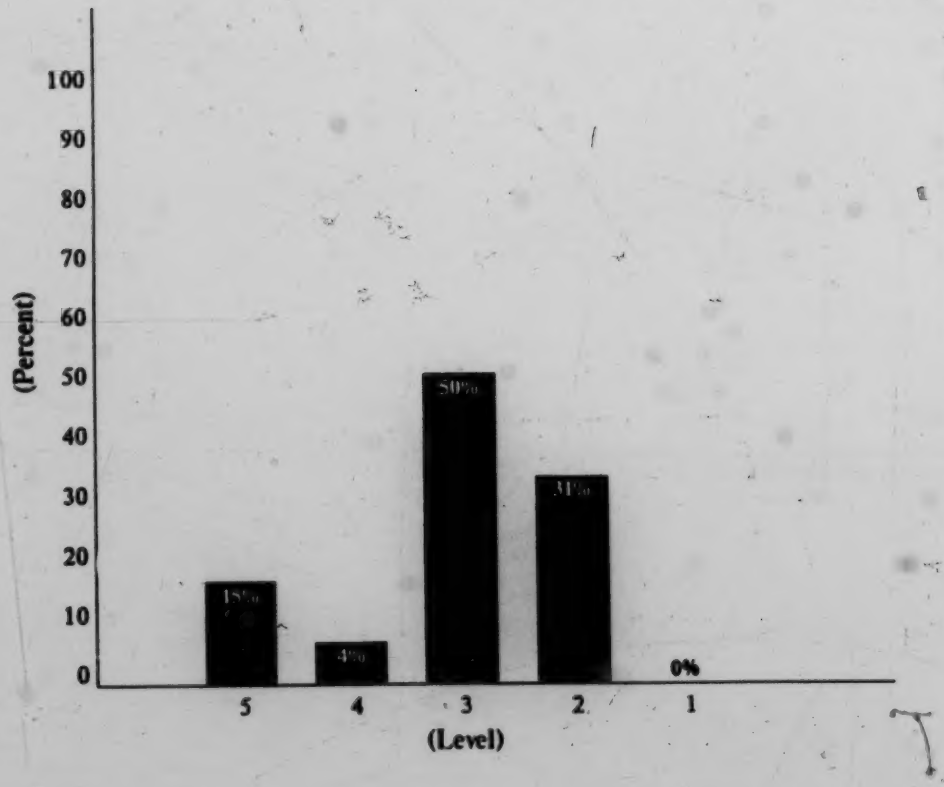

Figure 3. Content Relationship Status of Captions and Main Body Text

redundancy), 31% were rated at level 2 (nonredundant, thematically related), and 0% were rated at level 1 (nonredundant, thematically unrelated).

The mean for the caption-sentence pairs was 3.04. The 3.04 mean indicated that the content relationship between the captions and main body text is low. For the most part the caption-sentence pairs matched in one out of the three elements (subject, object, or verb).

Of the relationships evaluated, i.e. pictures and main body text, pictures and captions, and captions and main body text, the strongest degree of compatibility existed between the picture and the caption content (4.41 mean). By comparison, the degree of compatibility between the picture content and the main body text's content, was relatively low on the redundancy scale (3.14 mean). Also, the degree of compatibility between the content of the captions and the content of the main body text was low on the scale (3.04 mean).

Interviews

The individuals interviewed represented personnel at the provincial, district, and school levels: Administrators, teachers and students who influence the screening and selection of textbooks used in schools. The hierarchy of channels through which the screening and selection of textbooks are put is as follows:

1. Provincial Department
2. School District(s) Central Office
3. Department Head(s) - i.e. teacher(s)
4. Students - i.e. feedback from pilot study and/or application.

People Who Screen and Select Educational Textbooks

The following interview respondents received the same interview format. The summary for each respondent was extracted from the transcripts and represents the thoughts, beliefs, and actions of the interviewees as described to the researcher. The order in which the respondents' viewpoints were discussed was based on the hierarchy of textbook review and selection, i.e. In Alberta, first, textbooks must be screened and approved by a provincial department before they are listed as "basic" or "support" reference texts in curriculum guides.

Secondly, school districts then screen and select the basic and supplementary textbooks from the list recommended by the provincial department. Teachers review and select resources for the courses they are teaching, based on the recommendations made at the provincial and district level, and based on their program needs. The summary of the interview results will be discussed in two parts and based on the following hierarchy:

A. Textbook Screening and Selection Personnel at an administrative level: The provincial and district level administrators.

B. Textbook Screening, Selection, and User Personnel at a school level: (i) teachers/department heads, (ii) students.

A. Textbook Screening and Selection Personnel at the Administrative Level

The interview summaries for the representative from the provincial department, and the two representatives from the different school districts (one from a municipal protestant district and one from a municipal catholic district), will address the following:

1. **Background**: The affiliation, title, responsibilities, and training/experience of each interviewee.

2. **Process and Criteria**: The general process that each interviewee went through in order to screen and select textbooks used in school(s); the criteria that are followed during the screening and selection process.

3. **Picture Function and Picture-Print Relationship**: The extent to which the function of pictures and picture-text relationship were considered during the screening and selection process.

It should be noted that these administrators solicit the expertise and feedback from professionals in the education field. However, the input of the various educational resource people will be discussed in the context of each interview.

Background

Interviewee "1" (hereinafter referred to) represented a provincial department and served as a Curriculum Design Coordinator. The Curriculum Design Coordinator is responsible for seeing resources through

from submissions from publishers to authorization at the Deputy Minister level; to provide publishers with suggestions on how textbooks might better fit curriculum prescribed by the province; and to write reports on media being considered for use. Interviewee "1" held a Bachelor of Education, had ten years teaching experience, served as a language arts coordinator, and worked under private contract analyzing and evaluating curriculum prior to her appointment with the province.

Interviewee "2" (hereinafter referred to) represented a city protestant school district, in the same province as interviewee "1", and served as a Director of Curriculum. The Director of Curriculum is responsible for defining courses of study, the outcomes, and expectations for all courses ranging from kindergarten to grade 12. In addition, the Director is responsible for overseeing all instructional resources recommended by the province -- i.e. serving as a liaison between subject area specialists, teachers, and the board -- and ultimately deciding which resources will be approved for the district. Interviewee "2" held a Bachelor of Education, had eighteen years teaching experience, and administrative experience at a school level prior to her position as Director.

Interviewee "3" (hereinafter referred to) represented a city catholic school district, in the same province as interviewee "1" and "2", and served as Supervisor of Curriculum Resources. The Supervisor of Curriculum Resources is responsible for coordinating the textbook rental program for the district, the identification of what resource titles will be listed for the district, and to serve as a liaison between subject consultants, teachers, and the board in order to determine which resources would be listed. Interviewee "3" held a Masters of Education, had numerous years of teaching experience, and had served as a social studies consultant prior to his position as Supervisor.

Process and Criteria: Screening and Selecting Textbooks

Interviewee "1" described the following sequence for the screening and selection of textbooks. First, school district superintendents are contacted on a province-wide basis. The superintendents are asked to submit names of persons (teachers, subject area specialists, etc.) who might serve on a review and selection committee. Committee members represent different zones, i.e. rural/urban, different levels of expertise, i.e. novice and experienced personnel. The committee members will have some background in the

subject area to which the resource being considered relates.

The criteria to which the interviewee and committee adhered are as follows:

(a) The resource must be curriculum fit -- Does the textbook match the philosophy of the curriculum approach? For example, if the curriculum for a given subject area states that the approach will be an issues oriented approach, a values oriented approach, and/or a process oriented approach then the resource must reflect that approach. Does the content of the textbook match the content of the curriculum? The two categories on which content is assessed are basic resource and support resource. A basic resource is expected to meet or match the curriculum on a very high level. Support resources may only address one or two aspects of the curriculum.

(b) The resource must reflect tolerance and understanding -- Does the resource reflect age groups, gender, ethnic groups, religious groups, socio-economic groups, and political belief systems in a positive and unbiased

manner? For example, if a textbook constantly refers to "he" when they really mean "he and she" then gender-bias would exist.

(c) The resource must contain certain instructional design components -- Does the whole thing hold together well? Does it deliver what the curriculum says it should deliver? For example, the curriculum philosophy might be to involve students in cooperative learning strategies and help students become independent thinkers/doers. However, the developer produces a resource that is teacher-centered and didactic and students are treated as passive learners. Does the resource reflect suitability for a certain target audience? For example, a resource intended for grade seven students should contain pictures, should use subheadings as advance organizers, should utilize questions as advance organizers, should use colour to break different things up, and should be reader friendly. Does the resource contain pictorial information? The text should use illustrations, i.e. photos, graphs, charts. Finally, Is the resource

durable? Durability standards are set by another provincial department.

(d) The resource must reflect developmental appropriateness -- Is the information appropriate for the age/grade level being targeted (Frye instrument determines readability, SMOG instrument is an indicator for the reading level required by the student-users of the resource)? Does it incorporate thinking and study skills? Does it encourage independent and cooperative learning?

Interviewee "2" indicated that the source from which the resources are initially compiled is the basic and support list provided by the province. The district relied on the fact that the resources listed by the province had already been rigorously analyzed and evaluated. The process and criteria that were employed by the district reflected their distinct board policy -- to support the use of a wide range of instructional and learning resources at varying levels of difficulty with diversity of appeal.

On a district level, the process of review and selection is first based on the province's list of

basic and support resources. Teachers are primarily responsible for selecting their own resources based on the list provided by the province. If a resource is recommended by consulting services, department heads, teachers, etc., but is not listed by the province, then Consulting Services reviewed it to determine if it appeared, at the surface, to meet the requirements of the curriculum. Next, teachers in the district would be recruited to pilot the resource. The publisher and/or producer of the resource must supply as many facts about the resource as possible. Teachers who piloted the resource must provide feedback. Following the review done by Consulting Services and the results of the pilot, the Director would then approve or disapprove the resource to be used on a district level.

The criteria used to approve resources on a district level were as follows:

(a) The resource must reflect the curriculum -- the philosophy, content, and approach must match those set out in the curriculum guide. However, it was the belief of interviewee "2" that no one textbook can do all things for one course. It was stated that generally many resources are utilized.

(b) The resource must reflect approaches and strategies consistent with principles of learning and the district priorities -- Is the level of difficulty suitable for the age level that the resource targets? Are there a wide range of youngsters who could use the resource? Have considerations been given to learning styles, thinking skills, learning theory, and student differences? Does the textbook reflect society and tolerance, i.e. free of discrimination and bias?

(c) The resource must reflect quality in content and physical characteristics -- Is the print-size appropriate? Does it contain illustrations? Is it durable? Is the resource easy to use? Is the resource copyright clean?

Interviewee "3" indicated that the district compiles its list of resources primarily from the recommendations made by the province. In addition, people who are very knowledgable in content related to a given program are solicited for input regarding resources. A resource will be brought in as a result of either hearing what the specific needs are in the field or input from the subject area consultants. The

resource would be brought in and previewed by consultants and/or sent out to the school(s) to be previewed. The feedback that is received from the subject area consultant(s) and/or teacher(s) in the field, determines whether or not the resource is approved and purchased by the district.

The criteria to determine whether or not a particular resource was suitable were as follows:

(a) The resource must fit the curriculum: Does the resource reflect the curriculum mandated by the province? Does the textbook encourage diverse skills and represent the approach of the subject area as recommended in the curriculum guides.

(b) The [illegible] must be suitable for the target audience [illegible]s the textbook relevant to the age level of the students? Is the textbook readable and suitable for the students in a given grade?

(c) The resources content must encourage diverse skills and approaches -- Does the textbook encourage reading, writing, listening, speaking, and viewing skills? Does the textbook contain characteristics, other than

straight text, that stimulate and motivate learning, i.e. clear graphs, pictures, maps, colour, and variety.

(d) The resource must represent the blueprint that has been laid out for the exams, particularly for grades 3, 6, 9, and 12 -- Does the resource address content that is in keeping with exam expectations?

(e) The resource must be durable -- Is the resource soft cover or hard cover? How will it hold up over time with continuous use?

Picture Function and Picture-Print Relationship: Viewpoints and Application to the Screening and Selection Process

Interviewee "1" described the function of pictures as being a reinforcer of the text information, i.e. the pictures should reiterate content stated in the text. Pictures should be used as a vehicle from which questions could be devised either by the teacher or student to build on information provided in the written text and/or pictures. For example, students could be asked to describe what they see and/or draw inferences from the illustrations, i.e. a motto under the Brazilian flag says..."order and progress". The teacher might explore with students as to why the

Brazilian motto is order and progress. The symbolic content contained in the flag might be further interpreted and discussed. Such content may not have been addressed in the written text.

Interviewee "1" stated that the committee is encouraged to look for the following: Do the pictures reinforce a stereotype, e.g. gender, age, race, socio-economic, religious, political, etc.? Do the pictures represent something that the learners can relate to and understand, e.g. using the performer,"Sting", to convey a concept relating to the performing arts? Are there bright colours and exciting things going on, e.g. will it capture the students' attention? Are there lots of pictures to reinforce written content throughout?

Interviewee "2" stated that illustrations should have some bearing on the literal content or material. Pictures should be useful, not just entertainment. Illustrations should be used actively by teachers and students, i.e. to encourage a variety of strategies for children to demonstrate their learning. She also went onto say: "I don't spend alot of energy on how the textbook is set up or what it looks like. I might comment that it is a pretty one, or isn't this one appealing to look at. If there is too small print and

no illustrations then the kids won't read it, that's not good. If illustrations have no bearing on the content or material then they are a waste of time and space."

Interviewee "3" described pictures as being a source from which to get information above and beyond the text, or to get more details about what is being said in the text. In addition, students should be able to practice interpreting from symbols other than the printed word. "They (students) are in an age where they watch television more than they spend time in school."

Interviewee "3" stated that there should be a relationship between the pictures, written explanations, and related activities. In addition, there must be some room to get the students thinking, i.e. pictures should extend, build-on, and reinforce what has been said in the written portions.

B. Textbook Screening, Selection, and User Personnel at the School Level

(i) Teachers/Department Heads

The interview summaries for the two teachers and/or department heads (one from a municipal

protestant district and one from a municipal catholic district), will address the following:

1. **Background**: The affiliation, title, responsibilities, and training/experience of each interviewee.

2. **Process and Criteria**: The general process that each interviewee went through in order to screen and select textbooks used in their school; the criteria that are followed during the screening and selection process.

3. **Picture Function and Picture-Text Relationship**: The extent to which the function of pictures and picture-text relationship were considered during the screening and selection process.

Background:

Interviewee "4" (hereinafter referred to) was a junior high school teacher with a protestant school board in a large city. She had a Bachelor of Education, worked on curriculum design committees, i.e. reviewed the resources that corresponded to the courses she taught, and she had accumulated seven years of teaching experience.

Interviewee "4" taught half-time social studies and half-time physical education at the grade seven and eight levels. She was responsible for coordinating all the social studies department, i.e. making sure the right curriculum, the right books, and the right units were being implemented. Interviewee "4" was ultimately responsible for selecting the resources that would be used in social studies courses offered at her particular school.

Interviewee "5" (hereinafter referred to) was a junior high school teacher with a catholic school board in a large city. She held a Bachelor of Education, had three years of teaching experience, and had experience piloting resources.

She taught half-time social studies and half-time language arts at the seventh, eighth, and ninth grade level. In addition to the teaching responsibilities, interviewee "5" served on the social studies and language arts resource committees at her school. At the local school level, she piloted resources that the committee screened, and provided feedback about whether or not the resource should be purchased and used in all classes.

Process and Criteria: Screening and Selecting Textbooks

Interviewee "4" was acting as the department head for social studies. The person who had previously served as department head was on sabbatical. The former department head would frequently visit publishers, collect information on all the new grade seven and eight social studies textbooks, and bring all the information back to the interviewee. The interviewee would then provide feedback on what she thought of the resources in general. Interviewee "4" would solicit the opinions of the other teachers who taught social studies. Ultimately, she would select the resources used in the grade seven and eight social studies programs for the school.

The qualities that interviewee "4" looked for in textbooks were:

1. The resource must reflect certain physical qualities -- bold headings, attractive layout, and some pictures that explain the material.

2. The resource must reflect content that relates to the curriculum that teachers must teach -- information, related

activities, and study questions should address the objectives set out in the curriculum guide.

In the case of interviewee "5's" school, six people served on a committee that was in charge of reviewing and selecting the resources. For the most part, the committee's selection was based on the recommendations made by the province.

The interviewee described the following characteristics that textbooks should have in order for them to be acceptable:

1. The textbook must be compatible with the curriculum set out by the province.

2. The textbook must reflect a variety of methods in presenting information, i.e. motivating activities, the quality and frequency of illustrations, and use of colour.

3. The textbook must be suitable to the interests and age level of the readers.

Picture Function and Picture-Print Relationship: Viewpoints and Application to the Screening and Selection Process

Interviewee "4" felt that pictures should be up to date (current situations and events that

students understand and relate to). Pictures should contain colour, i.e. for motivational purposes. The pictures should be able to promote thinking and should allow students visual access to what it is being explained in the written word.

Interviewee "5" felt that pictures should encourage the students to read the book -- i.e. motivational. Pictures should promote better understanding of what is being described in words. Pictures should provide those details and enrichment that are lost in literal translations.

(ii) Grade Seven Students

Six grade seven students were interviewed. Three were selected from protestant junior high schools and three were selected from catholic junior high schools. The same instrument and format was used for all of the student interviews.

The summary of the responses given by the six interviewees is based on the five questions posed to each. Question "4" was asked only if pictures were mentioned in question "3". The questions asked and responses given by the six interviewees were as follows:

1. What was the title of your favorite social studies textbook used this year?

   The book preferred by all of the interviewees was "Japan: Its People and Culture".

2. Why did you like this particular textbook?

   The reasons that the interviewees liked this particular book were:

   (a) It had lots of information that was easy to read and understand, i.e. large print size, clear chapter and subtitle identification, vocabulary that was at a level they could understand, glossary of terms at the bottom of each page, the use of boldface type to emphasize important information.

   (b) It had lots of bright, colourful, and explanatory pictures, i.e. "it was fun to look at and the pictures helped me understand the words", "the pictures were up-to-date, the

captions underneath the pictures helped to explain the picture's content".

3. What things should textbooks contain in order to help you learn the information?

The elements that the interviewees described were related to the following:

(a) organization of the book itself, i.e. "They could put an index in the book so that we could find where everything is", "The definition of the hard words should be put at the bottom of the page", "They should put a review section at the end of each unit so that we know what to study for tests", "The titles of the units should be big and bold so that we know what it is all about";

(b) the degree of difficulty of words and explanations, i.e. "They should put sentences underneath the pictures so we know what is going on", "The glossary is a helpful thing. If I don't know what some words mean, all I have to do is look them up in the

glossary", "The explanations should be simple so that everybody can understand the book";

(c) the size of print, i.e. "Sometimes the words are so small that you have to squint to read it", "The medium-sized words makes it easier to see";

(d) the inclusion of pictures to both motivate and further explain written information, i.e. "There should be lots of colourful pictures because I think they make you want to read the book more", "Colourful pictures always attract people's attention", "I'll probably never go to these places so the more the book can tell us and show us, the more we'll learn about it", "Pictures of the different topics and easy words make it easier to remember what it was all about", "It should have alot of pictures to help the reader understand the topic. It should also have colour and a good appearance to make the reader have more interest in the topic".

4. What purpose should pictures serve in a textbook?

(a) pictures should serve to enhance the interest and enjoyability of using the textbook, i.e. "Pictures make it (the textbook) interesting...not boring", "After I'm finished my reading assignment, I'll flip ahead and just look at the pictures", "The pictures should liven up the book", "They (pictures) should make us laugh", "Books are more enjoyable if there are pictures in it", "I learn better from books that have lots of interesting pictures than books that use boring words everywhere";

(b) pictures should serve to clarify sentence information, i.e. "Sometimes the words are difficult to understand. The pictures help us understand them (difficult words)", "The pictures should help us remember the important things", "Pictures can make it easy to understand the explanations. Sometimes, I don't

know what the words are saying. Once I see the picture, I do understand", "The pictures help me understand the topics better. It makes it easier to study for our tests", "The pictures should explain the hard words and just show us what they mean", "Our teacher asks us to read to ourselves sometimes. I don't have to put my hand up all the time if the pictures tell me something I don't understand";

(c) pictures should serve to allow students to visually experience the topic(s), i.e. "They (pictures) show me what things really look like. The book on Japan showed us what kids in Japan wear, where they live, and what kinds of things they do. I've never seen any of that before so it was interesting to look at", "It's easier to imagine what other people live like if there are lots of pictures".

The motivational value of pictures to the students was expressed by each of the interview respondents.

Students were more inclined to want to use the textbook if it contained pictures. In addition, the importance of explicative pictures, i.e. pictures that serve to explain, clarify, and detail information contained in the text, was acknowledged by all of the students interviewed.

In-school Study

Introduction

The predictive hypothesis for this study was: **Students' immediate and delayed recall of textual information will be affected by the redundancy status between pictures and text.** The analysis involved comparing the achievement differences of immediate and delayed recall tests between the three treatments.

Interpretation of Test Results

Two intact classes were assigned to each treatment. To test the significance of the difference between the means of the three treatment groups, the method of analysis of covariance was applied. Kerlinger states that: "The investigator often must use classes intact. Through the analysis of covariance it is often possible to control class or other group differences statistically" (Kerlinger, 1967, p.350).

Because the experiment involved reading and remembering information, reading comprehension differences were taken into account. Reading comprehension scores were obtained from the Canadian Achievement Test (C.A.T.), written by the subjects in grade six. The means for each treatment group on

reading comprehension were calculated using the raw scores obtained from the subjects' records. The significance of the differences between the print-only, nonredundant, and redundant means were adjusted based on reading comprehension as the covariate in the analysis.

The method involved a repeated measures analysis of covariance, two-factor design, i.e. to analyze the significance of group by time, and three treatments by two different test times. The data were processed using the Statistical Package for the Social Sciences, Version X (SPSSx). For purposes of interpreting the data, the three null hypotheses were developed as indicated below.

Hypothesis 1: Immediate Recall

There will be no significant difference in the immediate recall of the text among the groups based on achievement means of the posttest.

Summaries of the means, variances, and ranges of the immediate recall test scores for each of the three groups are presented in Table 2. Inspection of the means in the table, as well as the graphical presentation (Figure 4), indicated that only slight differences existed between the three groups,

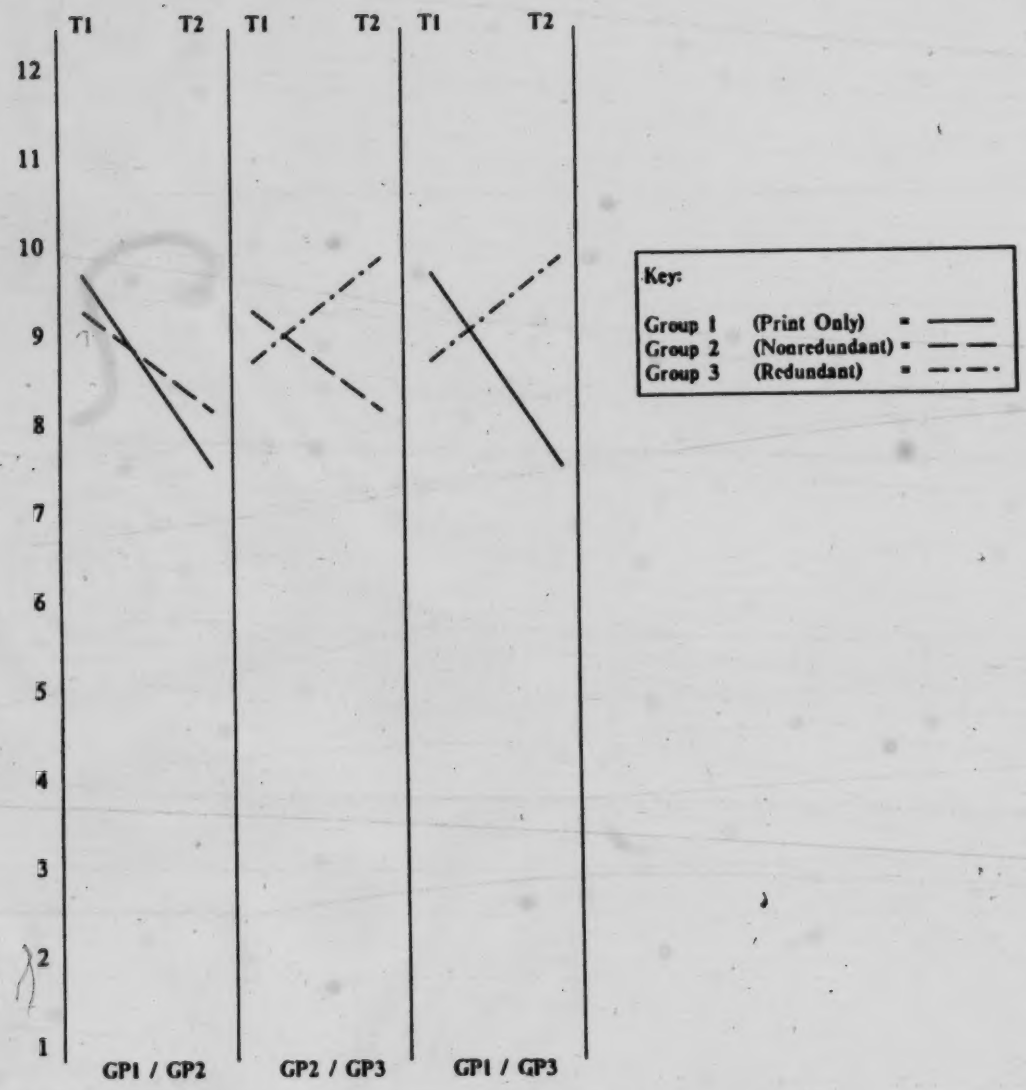

Figure 4. Pattern of Mean Score Achievement Between the Treatments for the Immediate and Delayed Recall Test

print-only, nonredundant, and redundant, on the immediate recall test.

Inspection of the mean scores for test 1 (immediate recall) indicated that the print-only treatment measured the highest (9.73) compared to the nonredundant (9.30) and the redundant (8.80) treatment groups.

Hypothesis 2: Effect of Time on Recall

There will be no significant difference in the delayed recall of the text among the groups based on achievement means of the posttest.

Summaries of the means, variances, and ranges of the immediate recall test scores for each of the three groups are presented in Table 2. Inspection of the means in the table, as well as the graphical presentation (Figure 4), indicates that greater differences existed between the three groups, print-only, nonredundant, and redundant, on the delayed recall test. Furthermore, the mean scores for test 2 (delayed recall) reflect a reversal in the pattern of recall ability from test 1 to test 2.

Inspection of the mean scores for test 2 (delayed recall) indicates that the redundant treatment measured

the highest (9.93) compared to the nonredundant (8.15) and the print-only (7.60) treatment groups.

Hypothesis 3: Interaction of groups with time

There will be no significant difference resulting from interaction of groups with time.

The means and standard deviation of the immediate recall and the delayed recall scores for each of the three groups are presented in Table 2. Inspection of the means for test 1 (immediate recall) indicates that the print-only treatment group achieved the highest scores on test 1 (9.73) compared to the nonredundant (9.30) and redundant (8.80) treatment groups.

The print-only group achieved a mean of 9.73 on the immediate recall test and only 7.60 on the delayed recall test. The nonredundant group achieved 9.30 on the immediate recall test and 8.15 on the delayed recall test. The redundant group achieved the lowest mean score on the immediate recall test, 8.80, and the highest on the delayed recall test with a mean of 9.93. Thus, the print-only group experienced a marked decline on the delayed recall test while the redundant group achieved a marked improvement on the delayed recall test.

TABLE 2: Summary of Achievement Means and Standard Deviations for the Immediate and Delayed Recall Tests, and Reading Comprehension, the Covariate

Treatments	Test 1 Mean	Test 1 Std	Test 2 Mean	Test 2 Std	Comp. Mean	Comp. Std
Print-only	9.73	1.89	7.60	2.66	21.97	4.81
Nonredundant	9.30	2.02	8.15	2.51	22.47	7.08
Redundant	8.80	2.08	9.93	1.54	26.82	6.15

Analysis of Variance

An analysis of variance with repeated measures was performed on the scores to see if the differences across groups and from test 1 to test 2 were large enough to be statistically significant beyond the 0.05 level. There were no significant differences in the means for the immediate recall test. There were significant differences in the means for the delayed recall test. There were also significant differences in the means for interaction between the groups over two test times. Based on the results of the analysis of variance, the study indicated that the first null hypothesis failed to be rejected. However, the second and third null hypotheses were rejected.

The Covariate: Reading Comprehension

Given that the pattern of mean score achievement was reversed between the groups from test 1 to test 2, the reading comprehension mean scores provided some insight into a possible reason for this change over time. The redundant treatment group measured the highest (26.82) compared to the nonredundant (22.47) and the print-only (21.97) groups. The disparity between the reading comprehension mean scores of the three treatments, the very foundation on which the study is based, made it necessary to statistically adjust the scores, using comprehension as the covariate.

The reading comprehension scores, Table 3, obtained from case records, had a significant effect on the three treatment groups, yielding an F-Ratio of 8.34, significant beyond the 0.05 level (0.00040).

Table 3: Analysis of Variance - Summary of F-Ratios for Comprehension

Sources of variation	Sum of squares	D.F.	Mean squares	F ratio	Prob
group effect	308.59	2.0	154.29	8.34	0.00040
cases (gp)	2275.76	123.0	18.50		

Analysis of Covariance

To adjust for the uncontrolled variable (biased sampling), an ANCOVA (analysis of covariance) on the achievement data was performed using comprehension as the covariate. The results of this analysis (Table 4) yielded a probability level of 0.17689 for the group effect and 0.24985 for the time effect. Since there were no significant differences in the means for the immediate recall test or in the means for the delayed recall test the first and second null hypotheses were not rejected. The analysis did not reveal a significant difference in the effect of the treatments on immediate or delayed recall.

There were significant mean differences for interaction between the groups over two test times. The interaction of groups with time yielded a probability level of 0.0. There was a significant interaction of groups with time beyond the 0.05 level. Based on the results of the analysis of covariance, the third null hypothesis was rejected.

The significant interaction of groups with time suggests that the redundant text-picture condition does not necessarily affect immediate recall. However, the

redundant text-picture condition does positively affect delayed recall.

Table 4: Achievement Test Analysis of Covariance - Summary of F-Ratios for group effect, time effect, and interaction of groups with time (Covariate -- Comprehension)

Sources of variation	Sum of squares	D.F.	Mean squares	F ratio	Prob
group effect	23.65	2.0	11.82	1.76	0.17689
cases (gp)	820.90	123.0	6.67		
time effect	2.56	1.0	2.56	1.34	0.24985
interaction of groups with time	105.55	2.0	52.77	27.60	0.0
time*cases (gp)	0.05	1.0	0.05		

Contrast Analysis of Interaction of Groups With Time

The contrast analysis revealed that there was no significant difference between the print-only and the nonredundant groups with the covariate (0.7125). However, there was a significant difference between the print-only and the nonredundant groups without the covariate (0.0265). There was a significant difference between the nonredundant and redundant groups with or without the covariate (0.0013, 0.0000 respectively). There was also a significant difference between the print-only and redundant groups with or without the covariate (0.0003, 0.0000 respectively). (See Table 5)

Table 5: Summary of Contrast Analysis of Interaction Between the Three Treatment Groups (With and Without Covariate)

Treatments	Probability (with covariate)	Probability (without covariate)
Print-only and Nonredundant	0.7125	0.0265
Nonredundant and Redundant	0.0013	0.0000
Print-only and Redundant	0.0003	0.0000

There was a significant relationship between the covariate (comprehension) and the dependent variables (the three treatment groups -- print-only, nonredundant, and redundant; and time -- immediate and delayed recall). The significant differences in achievement occurred between the print-only and redundant treatment groups, and the nonredundant and redundant treatment groups.

CHAPTER 5: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The answers to the research questions on which this study was based, addressed content similarities and differences between the pictorial and textual elements in textbooks:

1. To what extent is the text content similar to the picture content in a basic reference textbook recommended by the province?

One basic reference textbook was evaluated in order to determine the degree of content relationship that existed between pictures and text. The subject, object, and verb of the pictures and text content were established as the criteria on which the evaluation instrument was based.

The results indicated that there was low redundancy between the pictures and the central sentences contained in the main body text, low redundancy between the captions and the central sentences contained in the main body text, and medium redundancy between the captions and pictures. The majority of the picture-sentence pairs and the

caption-sentence pairs had only one of the subject, object, or verb in common.

2. Do textbook selection personnel consider the function of pictures and their relationship to text information during the screening process?

Eleven textbook screening and user personnel were interviewed in order to determine if consideration is given to the learning value and function of pictures juxtaposed with text. The results indicated that the administrators, teachers, and students acknowledged the motivational, explicative, and retentional function of pictures during the screening and using process. However, the degree to which they regarded the picture-text relationship as important to the screening/using process varied between the interviewees.

The most rigorous screening, done at the provincial level, revealed that a number of instruments are used to assess whether or not a textbook is selected as a basic reference resource. However, no criteria-based instrument had been developed to evaluate the content relationship between pictorial and text information.

Duchastel (1978, 1980) developed a foundation on which to base the functional relationship between pictures and print, i.e. motivational, explicative, and retentional. The administrators, teachers, and students acknowledged the importance of including pictorial elements in order to sustain interest in the textbook.

The motivational function of pictures was deemed as most important by the students. The explicative and retentional function of pictures was acknowledged as important by the administrators, the teachers, and the students. However, the extent to which it was applied during the screening and selection process is questionable based on the results of the textbook evaluation.

3. Do students exposed to redundant picture-text conditions recall and retain more information than students exposed to print-only and nonredundant conditions?

The purpose of this study was to investigate the

effect of picture-text content relationship on students' immediate and delayed recall achievement. One hundred and twenty six grade seven students were invited to participate in a study to compare the effects of print-only, nonredundant, and redundant conditions on students' immediate and delayed recall of central text information.

The design was a posttest, analysis of covariance (the covariate was reading comprehension), to test for immediate and delayed achievement differences between the three conditions.

Statistical analysis of the data resulted in failure to reject two of the three null hypotheses. There was no significant difference in the immediate recall achievement means among the groups. There was no significant difference in the delayed recall achievement means among the groups.

There was a significant difference resulting from interaction of groups with time. The redundant treatment group achieved the lowest mean on the immediate recall posttest compared with the print-only and nonredundant treatment groups. The redundant treatment group achieved a significantly higher

achievement mean on the delayed recall posttest than the print-only and the nonredundant treatment groups. Essentially, the pictorial status of the redundant stimulus had a significant effect on retention of central text information.

A possible explanation of higher recall scores in the redundant text-plus-picture (representational pictures) condition has been suggested by Levin (1981).

> "According to the representation function, pictures lay down a 'memory trace' that...is stronger than that associated with a strict verbal representation of the text" (1981, pp. 214-215).

Nugent (1982) explained that if information is conveyed through both linguistic symbols and iconic symbols, students could alternate between the two to obtain information. In this study, the redundant picture-text stimulus provided the subjects with the same information through two different codes, the linguistic code and the iconic code. Dual coding of central sentence information seemed to have a positive effect on the students' ability to retain and recall the information on the delayed recall test.

The explicative and retentional function of the picture-text relationships proved to be evident in the

context of this study. By varying the extent to which pictures and text matched in the reading stimuli, a greater understanding of how the three conditions affected students retention of central information was achieved.

Conclusions

Educational textbooks have been, and will continue to be, a medium through which information is communicated to students. Previous research studies and this study have provided insight into the characteristics and elements of textbooks that may enhance student learning.

The criteria-based instrument used in evaluating the content relationship status between pictures and text provided a standardized approach to assessing the potential function and learning benefits of pictures combined with text. The interviews revealed the need for a standardized evaluation approach in that the interviewees varied in their perceptions and viewpoints as to how pictures and text interact. The varying viewpoints make the textbook screening and selection process mainly individualistic and intuitive. It is hoped that standard criteria will make intuitive design practices and disparate standards, in the context of

screening and selecting educational textbooks, a thing of the past.

As concluded in previous research and in this study, the impact that content redundancy between pictures and text has on students' ability to retain important text information indicates a need to focus on the learning benefits and functions of pictures, juxtaposed with text, in educational textbooks evaluated, selected, and used in classrooms.

Recommendations

1. Textbook Evaluation

In this study there was evidence that the content relationship status, between pictures and text in a basic reference textbook recommended by the province, was relatively low. Future research should examine the content-relationship status of current basic reference textbooks that have been approved by the province. In addition, this study focussed on the subject of social studies at the grade seven level. Future research should examine the content relationship status of textbooks in other subject areas, across all grade levels.

Additional studies should also attempt to build on the criteria, i.e. subject, object, verb, applied to develop the instrument used to assess the content relationship of the textbook. For example, this study did not take into consideration any adjectives, i.e. descriptors making reference to colour, size, texture, proportion. Future studies could consider other descriptors, contained in the central text information, that might be reiterated in the pictorial elements.

In order to determine whether or not textbook content evaluation is an effective process overall, the instrument used in this study should be applied to evaluating more textbooks in assorted subject areas. Given that the province is responsible for screening and selecting textbooks that will be used in schools, it is recommended that the province pilot, and if successful, implement a standard system to evaluate picture-text content relationships. Furthermore, the province could develop guidelines that schools and publishers could follow based on a standard system of evaluation.

2. Interviews of Textbook Screening/Selection Personnel

In this study, it was evident that there were similarities and differences noted between the interviewees in the degree to which the content relationship between pictures and print were regarded as important. Additional interviews could be conducted with provincial, administrative, and teacher personnel who represent different subject areas and/or school jurisdictions.

Future studies could poll the opinions of a larger and more diverse sample. For example, provincial representatives in other provinces could be interviewed in order to establish the similarities and differences of textbook screening and selection criteria between the provinces.

Administrators, teachers, and students from a larger sample of school districts could be interviewed in order to establish the similarities and differences between school districts. A larger sample would provide more insight into the screening process and criteria that are applied to the selection of textbooks from a greater cross-section of provincial and educational environments.

3. In-school Study

This study indicated that there was a significant interaction of groups with time, i.e. achievement differences, on the immediate recall and delayed recall posttests, for print-only, nonredundant, and redundant conditions.

Future research could focus on applying this research question to other grade and/or age levels. For example, adult learners could be targeted in order to determine the effect of redundant pictures and text on their ability to recall central text information. In addition, stimulus relating to different subject areas and grade levels should be tested. This application may provide more insight into whether or not the content-relationships between pictures and print have an effect on students' delayed recall across all populations, grade levels, and subject areas.

The classification of pictures, to which the pictorial elements used in this study belonged, was representational, i.e. pictures that physically resemble a thing or concept. Future research could explore the effect of content relationship on immediate and delayed recall using analogical, i.e. a picture that depicts a concept or topic by showing something else and suggesting a similarity, and arbitrary pictures, i.e. pictures that are highly schematized and

do not necessarily look like the object or thing it is supposed to represent. More insight might be gained about how pictures effect learning from sentence information under each classification.

For this study, the placement of the pictures in the experiment treatments resembled that of the original source from which the stimuli was adapted. Future research could vary the placement of pictures, i.e. preceding, following, or placed beside the print information to which it is related, in the stimulus.

Provinces and various school jurisdictions should continue to pilot picture-text content redundancy studies. Conducting such studies may rely on experts in specialized fields which may be costly in the beginning. However, monies would be ultimately saved if the textbooks selected reflected superior quality in all aspects, including strong picture-text redundancy.

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APPENDIX A. QUESTIONNAIRES FOR ADMINISTRATIVE, TEACHER, AND STUDENT PERSONNEL

ADMINISTRATIVE PERSONNEL QUESTIONNAIRE

1. What is your title/position?

2. What is your background and training?

3. What are your current responsibilities?

4. What specific elements and components do you look for in textbooks?

-------If pictures are mentioned in question 4-------

5. What characteristics must be contained in the pictures and what function should they serve?

TEACHER QUESTIONNAIRE

1. What is your position?

2. What is your background experience with respect to selecting resources?

3. What are your current responsibilities?

4. What do you look for when selecting textbooks?

------If pictures are mentioned in question 4-----

5. What characteristics and/or functions do you think the pictures should serve?

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STUDENT INTERVIEWS

1. What was the title of your favorite social studies textbook that you have used this year?

2. Why did you like this textbook?

3. What things should be put into a textbook in order to help you learn?

--------If pictures are mentioned in question 3--------

4. What should the purpose of pictures be in a textbook?

5. The mayor would like your advice on making a textbook that describes your city to tourists. What should the mayor put in this book?

APPENDIX B. PRINT-ONLY READING STIMULUS

September 16, 1991

Jo-Anne Heard
31 Mission Avenue
St. Albert, Alberta
T8N 1J2

Dear Ms. Heard,

Plains Publishing Inc. will grant permission for the inclusion of Unit II from the text the *Peigan: A Nation In Transition* as an appendix in your research project. We understand it includes four variations of pictures and prints of Unit II.

We wish you success in your thesis and look forward to receiving information on your project.

Yours truly,

Darlene Donahue
Plains Publishing Inc.

Plains Publishing Inc.
15879 - 116 Avenue, Edmonton, Alberta, Canada T5M 3W1 Tel.: (403) 451-0871 Fax: (403) 455-1388

Jo-Anne Heard
31 Mission Avenue
St. Albert, Alberta
T8N 1J2

March 21,1990

Dear Ms. Heard;

In response to your letter dated March 14,1990, we give you permission to photocopy a class set (30) of Unit 11 from the text "The Peigan" A nation in Transition.
We request that a copy of the results of your study be forwarded to us upon completion.

Yours truly;

Darlene Donahue

Darlene Donahue

PEIGAN CLOTHING

Although trade cloth was used by the mid-nineteenth century, traditional styles still existed. Men and women preferred the trade blanket to buffalo robes worn in the cold winter months.

A man wore the blanket wrapped around his body, leaving his left shoulder covered and his right arm and shoulder uncovered. The garment was held in place by grasping the two ends with his left hand underneath the robe. When couring, a man pulled the blanket over his head like a shawl and kept both arms covered. Women wore belts around their waists to keep their blankets in place. This allowed the top part to fall freely when they needed both hands to work.

Men often wore calico or flannel shirts, or Hudson Bay Company blankets, which were obtained from the fur traders. Their finest clothing was made of antelope or bighorn skins. Two skins were needed to make a shirt, which was pulled over the head. One skin formed the front while the other formed the back. The legs of the animal hung down as trailers. Red flannel bordered the neck opening. Over the centre of the front, a rectangle of skin covered with quill work or beadwork was sewn. More beadwork was sewn over the shoulders and down both sleeves, covering the seams.

Leggings were made from the same material. They extended from the ankle to the hip where they were tied in a knot with rawhide. They fitted tightly. The seam would be covered with beadwork to match the shirt. Elaborate outfits were decorated with weasel skins. Sixteen or more weasel skins were required to decorate shirts and leggings. These suits would be worth three or more horses.

Some men painted black or brown horizontal stripes on their suits if they were instructed to do so in their dreams. These were regarded as personal medicines and were used in battles, ceremonies, dress parades, and for burial.

Men and women wore moccasins made of deer or elk skin in warmer weather and buffalo hide (hair inside) in winter. One piece of skin, folded along the inner side of the foot, provided both sole and upper. The sinew-sewn seam ran from toe to heel around the outside of the foot and up the back of the heel. Ankle flaps were added. Dress moccasins were decorated with quills and beads; everyday ones were not.

A young woman would be initiated into the art of quill work through a special ceremony. The first articles she made were presented to the sun as a gift.

Eagle-feather bonnets were reserved for the same special occasions. They were made of eighteen to thirty upright feathers inserted in a folded rawhide headband. The headband was covered with red flannel and was decorated with little brass discs and pendants of white weasel skins.

The woman's basic garment was a long, sleeveless dress, reaching almost to the ankles. Some dresses were made of trade cloth, but again, the finest were of antelope skins. One skin formed the front and one the back of the garment. They were sewn together at the sides, and both were sewn to a yoke of the same material.

Wives of wealthy men sometimes wore four rows of elk teeth on both the front and back of their dresses. Decorative patches of black and red flannel were sewn to the lower portions of fancy dresses.

Dresses were full below the waist to allow freedom of movement in mounting a horse and riding astride. They were tied at the waist by a broad belt of rawhide fastened with buckskin ties. Women wore knee-high leggings of skin or trade cloth decorated with quills or beads. They seemed to prefer beadwork when decorating their own clothes.

Medium-sized quills from the back and sides of the porcupine were preferred. Quills were dyed red, green, or blue by dampening the dye plant of the colour they wanted in water, placing the quills on top of the plant and wrappint it all in a piece of buckskin. This package was placed under the bed and pressed by the weight of the woman's body for a few nights. The quills were stored in elk-bladder containers until they were used.

Holes were made in the skin to be decorated with a metal awl. Sinew thread was passed through the holes to attach the quills. The quills were softened in the woman's mouth and were flattened when she drew them through her teeth.

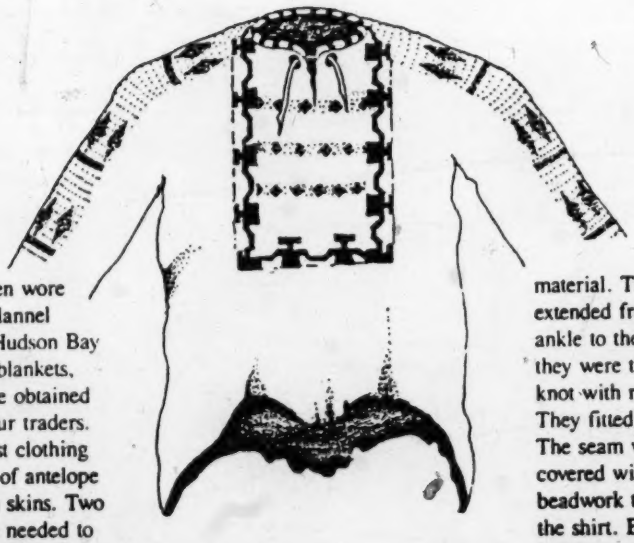
In later years when beads were supplied by the traders, the same technique was used. Beads were applied in narrow bands, and the same geometric designs were used. At that time, beads were very expensive, so they were used sparingly.

APPENDIX C. REDUNDANT READING STIMULUS

Peigan Clothing

Although trade cloth was used by the mid-nineteenth century, traditional styles still existed. Men and women preferred the trade blanket to buffalo robes worn in the cold winter months.

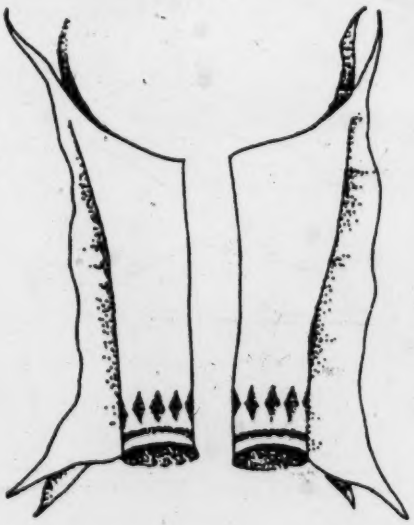
A man wore the blanket wrapped around his body, leaving his left shoulder covered and his right arm and shoulder uncovered. The garment was held in place by grasping the two ends with his left hand underneath the robe. When courting, a man pulled the blanket over his head like a shawl and kept both arms covered. Women wore belts around their waists to keep their blankets in place. This allowed the top part to fall freely when they needed both hands to work.



Men often wore calico or flannel shirts, or Hudson Bay Company blankets, which were obtained from the fur traders. Their finest clothing was made of antelope or bighorn skins. Two skins were needed to make a shirt, which was pulled over the head. One skin formed the front while the other formed the back. The legs of the animal hung down as trailers. Red flannel bordered the neck opening. Over the centre of the front, a rectangle of skin covered with quill work or beadwork was sewn. More beadwork was sewn over the shoulders and down both sleeves, covering the seams.

Leggings were made from the same material. They extended from the ankle to the hip where they were tied in a knot with rawhide. They fitted tightly. The seam would be covered with beadwork to match the shirt. Elaborate outfits were decorated with weasel skins. Sixteen or more weasel skins were required to decorate shirts and leggings. These suits would be worth three or more horses.

Some men painted black or brown horizontal stripes on their suits if they were instructed to do so in their dreams. These were regarded as personal medicines and were used in battles, ceremonies, dress parades, and for burial.



Eagle-feather bonnets were reserved for the same special occasions. They were made of eighteen to thirty upright feathers inserted in a folded rawhide headband. The headband was covered with red flannel and was decorated with little brass discs and pendants of white weasel skins.

The woman's basic garment was a long, sleeveless dress, reaching almost to the ankles. Some dresses were made of trade cloth, but again, the finest were of antelope skins. One skin formed the front and one the back of the garment. They were sewn together at the sides, and both were sewn to a yoke of the same material.

Wives of wealthy men sometimes wore four rows of elk teeth on both the front and back of their dresses. Decorative patches of black and red flannel were sewn to the lower portions of fancy dresses.

Dresses were full below the waist to allow freedom of movement in mounting a horse and riding astride. They were tied at the waist by a broad belt of rawhide fastened with buckskin ties. Women wore knee-high leggings of skin or trade cloth decorated with quills or beads. They seemed to prefer beadwork when decorating their own clothes.

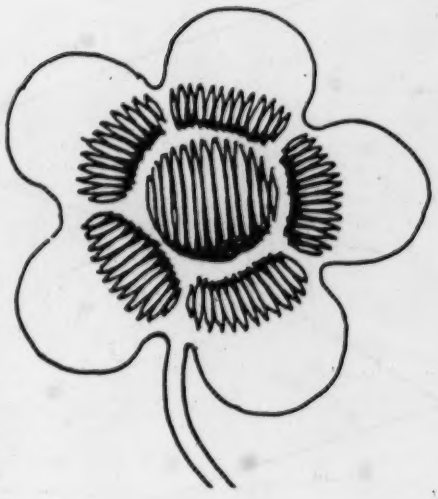
Men and women wore moccasins made of deer or elk skin in warmer weather and buffalo hide (hair inside) in winter. One piece of skin, folded along the inner side of the foot, provided both sole and upper. The sinew-sewn seam ran from toe to heel around the outside of the foot and up the back of the heel. Ankle flaps were added. Dress moccasins were decorated with quills and beads; everyday ones were not.

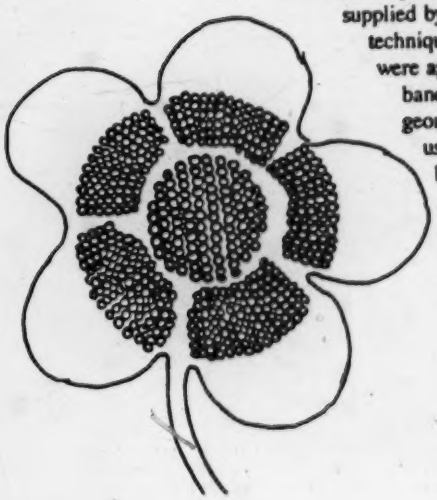
A young woman would be initiated into the art of quill work through a special ceremony. The first articles she made were presented to the sun as a gift.

Medium-sized quills from the back and sides of the porcupine were preferred. Quills were dyed red, green, or blue by dampening the dye plant of the colour they wanted in water, placing the quills on top of the plant and wrapping it all in a piece of buckskin. This package was placed under the bed and pressed by the weight of the woman's body for a few nights. The quills were stored in elk-bladder containers until they were used.

Holes were made in the skin to be decorated with a metal awl. Sinew thread was passed through the holes to attach the quills. The quills were softened in the woman's mouth and were flattened when she drew them through her teeth.

In later years when beads were supplied by the traders, the same technique was used. Beads were applied in narrow bands, and the same geometric designs were used. At that time, beads were very expensive, so they were used sparingly.





APPENDIX D. NONREDUNDANT READING STIMULUS

Peigan Clothing

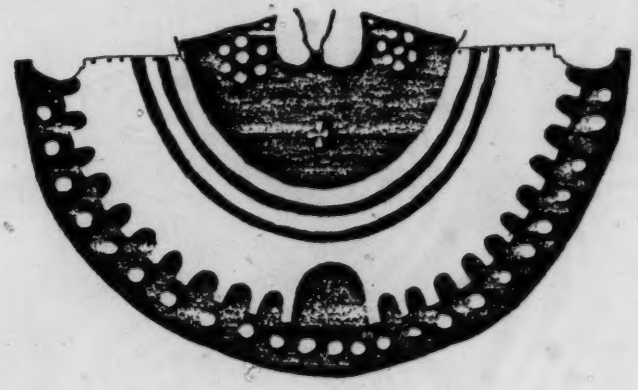
Although trade cloth was used by the mid-nineteenth century, traditional styles still existed. Men and women preferred the trade blanket to buffalo robes worn in the cold winter months.

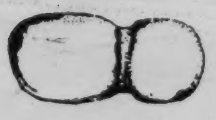
A man wore the blanket wrapped around his body, leaving his left shoulder covered and his right arm and shoulder uncovered. The garment was held in place by grasping the two ends with his left hand underneath the robe. When courting, a man pulled the blanket over his head like a shawl and kept both arms covered. Women wore belts around their waists to keep their blankets in place. This allowed the top part to fall freely when they needed both hands to work.

Men often wore calico or flannel shirts, or Hudson Bay Company blankets, which were obtained from the fur traders. Their finest clothing was made of antelope or bighorn skins. Two skins were needed to make a shirt, which was pulled over the head. One skin formed the front while the other formed the back. The legs of the animal hung down as trailers. Red flannel bordered the neck opening. Over the centre of the front, a rectangle of skin covered with quill work or beadwork was sewn. More beadwork was sewn over the shoulders and down both sleeves, covering the seams.

Leggings were made from the same material. They extended from the ankle to the hip where they were tied in a knot with rawhide. They fitted tightly. The seam would be covered with beadwork to match the shirt. Elaborate outfits were decorated with weasel skins. Sixteen or more weasel skins were required to decorate shirts and leggings. These suits would be worth three or more horses.

Some men painted black or brown horizontal stripes on their suits if they were instructed to do so in their dreams. These were regarded as personal medicines and were used in battles, ceremonies, dress parades, and for burial.





Eagle-feather bonnets were reserved for the same special occasions. They were made of eighteen to thirty upright feathers inserted in a folded rawhide headband. The headband was covered with red flannel and was decorated with little brass discs and pendants of white weasel skins.

The woman's basic garment was a long, sleeveless dress, reaching almost to the ankles. Some dresses were made of trade cloth, but again, the finest were of antelope skins. One skin formed the front and one the back of the garment. They were sewn together at the sides, and both were sewn to a yoke of the same material.

Wives of wealthy men sometimes wore four rows of elk teeth on both the front and back of their dresses. Decorative patches of black and red flannel were sewn to the lower portions of fancy dresses.

Dresses were full below the waist to allow freedom of movement in mounting a horse and riding astride. They were tied at the waist by a broad belt of rawhide fastened with buckskin ties. Women wore knee-high leggings of skin or trade cloth decorated with quills or beads. They seemed to prefer beadwork when decorating their own clothes.

Men and women wore moccasins made of deer or elk skin in warmer weather and buffalo hide (hair inside) in winter. One piece of skin, folded along the inner side of the foot, provided both sole and upper. The sinew-sewn seam ran from toe to heel around the outside of the foot and up the back of the heel. Ankle flaps were added. Dress moccasins were decorated with quills and beads; everyday ones were not.

A young woman would be initiated into the art of quill work through a special ceremony. The first articles she made were presented to the sun as a gift.

Medium-sized quills from the back and sides of the porcupine were preferred. Quills were dyed red, green, or blue by dampening the dye plant of the colour they wanted in water, placing the quills on top of the plant and wrapping it all in a piece of buckskin. This package was placed under the bed and pressed by the weight of the woman's body for a few nights. The quills were stored in elk-bladder containers until they were used.

Holes were made in the skin to be decorated with a metal awl. Sinew thread was passed through the holes to attach the quills. The quills were softened in the woman's mouth and were flattened when she drew them through her teeth.

In later years when beads were supplied by the traders, the same technique was used. Beads were applied in narrow bands, and the same geometric designs were used. At that time, beads were very expensive, so they were used sparingly.

APPENDIX E. IMMEDIATE RECALL POSTTEST

PEIGAN CLOTHING

Please read each question carefully and circle the letter beside the correct answer. Do not circle more than one answer for each question.

1. Men's finest clothing was made of antelope or bighorn skins. How did men put the shirts onto their bodies?

   A. Men pulled the shirts on over their heads.

   B. Men buttoned their shirt down the front.

   C. Men wrapped the shirt around their upper body.

   D. Men zipped the back and front together.

2. What was the basic garment worn by women?

   A. A short dress made of buffalo wool was worn by women.

   B. A shirt and leggings were worn by women.

   C. A long sleeveless dress, reaching almost to the ankles, was worn by women.

   D. A white plain cotton dress with long sleeves was worn by women.

3. What did men and women wear on their feet in warmer weather and in the winter?

   A. They wore leather boots all year round that were supplied by the traders.

   B. They wore trade cloth wrapped around their feet in warm weather and leather boots supplied by the traders in the winter.

   C. They wore brown buffalo skin shoes in the warm weather and bear skin boots in the winter.

   D. They wore moccasins made of dear or elk skin all year round.

4. Native men and women wore the trade blanket in the cold winter months. How did the man wear the blanket on his body?

   A. A man slipped his head into a hole which was cut into the centre of the blanket.

   B. A man pulled the blanket over his head like a shawl and kept both arms covered.

   C. A man would wear the blanket wrapped around his body, leaving the left shoulder covered and the right arm and shoulder uncovered.

   D. A man would wear the blanket wrapped around his waist in order to keep their legs warm when riding horses during the winter.

5. What did women prefer decorating their own garments with?

   A. Women preferred to decorate their garments with beadwork.

   B. Women preferred to decorate their garments with paintings of their children.

   C. Women preferred to decorate their garments with jewels and pearls.

   D. Women preferred to decorate their garments with dried leaves or flowers.

6. What was used to decorate the shoulders and sleeves of men's shirts?

   A. Feathers were sewn into the shoulders and sleeves for decoration.

   B. Quill work or beadwork was sewn onto the shoulders and down both sleeves for decoration.

   C. Dried flowers were glued onto the shoulders and sleeves for decoration.

   D. Hunting scenes were carved into the shoulders and sleeves with a sharp knife for decoration.

7. How did the men put the antelope or bighorn leggings onto their bodies?

   A. The leggings extended from hip to ankle where they were tied in a knot with rawhide.

   B. The leggings were pulled onto the legs like stockings.

   C. The leggings were wrapped around the legs and then pinned at the hips and ankles with quills.

   D. The leggings were wrapped around the legs and then fastened with snaps from hip to ankle.

8. What was the basic garment worn by women?

   A. A short dress made of buffalo wool was worn by women.

   B. A shirt and leggings were worn by women.

   C. A white plain cotton dress with long sleeves was worn by women.

   D. A long sleevless dress, reaching almost to the ankles, was worn by women.

9. Which answer best describes how the women's garment fit below the waist?

   A. The garments were tight below the waist which restricted their movement.

   B. The garments were full below the waist to allow freedom of movement when riding.

   C. The garments were full below the waist and tied at the knees to look like a balloon.

   D. The garments were baggy which allowed the women to run and ride horses easily.

10. What decorated the centre of the front of men's shirts?

   A. A rectangle of skin covered with quill work or beadwork was sewn onto the front of the shirt.

   B. Four teeth fron an elk were sewn onto the front of the shirt.

   C. Pictures of men's families were hand-painted onto the front of the shirt.

   D. A picture of a buffalo carved into deerskin was sewn onto the front of the shirt.

11. How did women keep their blankets in place on their bodies?

   A. Women held the blanket firmly in place with their left hand.

   B. Women wore belts around their waists to keep the blanket in place.

   C. Women pinned the blankets in place with porcupine quills or safety pins.

   D. Women kept the blankets in place by sewing an elastic into the wrist and waist band.

12. What was used to decorate Peigan clothing in the early years and in the later years?

A. Quills were used to decorate clothing in the early years and beads were used to decorate clothes in the later years.

B. Bird feathers were used to decorate clothing in the early years and quills were used to decorate clothing in the later years.

C. Diamonds were used to decorate clothing in the early years and beads were used to decorate clothing in the later years.

D. Paint was used to decorate clothing in the early years and fur was used to decorate clothing in the later years.

APPENDIX F. DELAYED RECALL POSTTEST

PEIGAN CLOTHING

Please read each question carefully and circle the letter beside the correct answer. Do not circle more than one answer for each question.

1. Native men and women wore the trade blanket in the cold winter months. How did the man wear the blanket on his body?

   A. A man would wear the blanket wrapped around his body, leaving the left shoulder covered and the right arm and shoulder uncovered.

   B. A man pulled the blanket over his head like a shawl and kept both arms covered.

   C. A man slipped his head into a hole which was cut into the centre of the blanket.

   D. A man would wear the blanket wrapped around his waist in order to keep their legs warm when riding horses during the winter.

2. How did men keep the blanket in place on their bodies?

   A. Men wore belts around their waists to keep the blanket in place.

   B. Men held the blanket in place by grasping the two ends with his left hand underneath the blanket.

   C. Because the blanket was heavy, men did not worry about keeping the blanket in place and used nothing.

   D. Men had sewn elastics in the neck, wrist, and waist bands of the blankets.

3. How did women keep their blankets in place on their bodies?

   A. Women held the blanket firmly in place with their left hand.

   B. Women kept the blankets in place by sewing an elastic into the wrist and waist band.

   C. Women pinned the blankets in place with porcupine quills or safety pins.

   D. Women wore belts around their waists to keep the blanket in place.

4. Men's finest clothing was made of antelope or bighorn skins. How did men put the shirts onto their bodies?

   A. Men buttoned their shirt down the front.

   B. Men pulled the shirts on over their heads.

   C. Men wrapped the shirt around their upper body.

   D. Men zipped the back and front together.

5. What decorated the centre of the front of men's shirts?

   A. A picture of a buffalo carved into deerskin was sewn onto the front of the shirt.

   B. Four teeth fron an elk were sewn onto the front of the shirt.

   C. Pictures of men's families were hand-painted onto the front of the shirt.

   D. A rectangle of skin covered with quill work or beadwork was sewn onto the front of the shirt.

6. What was used to decorate the shoulders and sleeves of men's shirts?

   A. Feathers were sewn into the shoulders and sleeves for decoration.

   B. Quill work or beadwork was sewn onto the shoulders and down both sleeves for decoration.

   C. Dried flowers were glued onto the shoulders and sleeves for decoration.

   D. Hunting scenes were carved into the shoulders and sleeves with a sharp knife for decoration.

7. How did the men put the antelope or bighorn leggings onto their bodies?

   A. The leggings extended from hip to ankle where they were tied in a knot with rawhide.

   B. The leggings were pulled onto the legs like stockings.

   C. The leggings were wrapped around the legs and then pinned at the hips and ankles with quills.

   D. The leggings were wrapped around the legs and then fastened with snaps from hip to ankle.

8. What was the basic garment worn by women?

   A. A short dress made of buffalo wool was worn by women.

   B. A shirt and leggings were worn by women.

   C. A white plain cotton dress with long sleeves was worn by women.

   D. A long sleevless dress, reaching almost to the ankles, was worn by women.

9. Which answer best describes how the women's garment fit below the waist?

   A. The garments were baggy which allowed the women to run and ride horses easily.

   B. The garments were full below the waist and tied at the knees to look like a balloon.

   C. The garments were full below the waist to allow freedom of movement when riding.

   D. The garments were tight below the waist which restricted their movement.

10. What did women prefer decorating their own garments with?

   A. Women preferred to decorate their garments with dried leaves or flowers.

   B. Women preferred to decorate their garments with beadwork.

   C. Women preferred to decorate their garments with jewels and pearls.

   D. Women preferred to decorate their garments with paintings of their children.

11. What did men and women wear on their feet in warmer weather and in the winter?

   A. They wore leather boots all year round that were supplied by the traders.

   B. They wore brown buffalo skin shoes in the warm weather and bear skin boots in the winter.

   C. They wore moccasins made of dear or elk skin all year round.

   D. They wore trade cloth wrapped around their feet in warm weather and leather boots supplied by the traders in the winter.

12. What was used to decorate Peigan clothing in the early years and in the later years?

    A. Bird feathers were used to decorate clothing in the early years and quills were used to decorate clothing in the later years.

    B. Quills were used to decorate clothing in the early years and beads were used to decorate clothes in the later years.

    C. Diamonds were used to decorate clothing in the early years and beads were used to decorate clothing in the later years.

    D. Paint was used to decorate clothihg in the early years and fur was used to decorate clothing in the later years.

APPENDIX G. TEXTBOOK EVALUATION DATA COLLECTION INSTRUMENT

TEXTBOOK EVALUATION SHEET

TEXTBOOK TITLE:_____

_____

Chapter/Unit #_____
Page#_____
Picture#_____

	High Redundancy	Medium Redundancy	Low Redundancy	Nonredundancy (thematically rel.)	Nonredundancy (thematically unrel.)	Caption Not Present
picture to main text	5	4	3	2	1	
picture to caption	5	4	3	2	1	CN/P
caption to main text	5	4	3	2	1	CN/P

Chapter/Unit#_____
Rage #_____
Picture #_____

picture to main text	5	4	3	2	1	
picture to caption	5	4	3	2	1	CN/P
caption to main text	5	4	3	2	1	CN/P

Chapter/Unit#_____
Page #_____
Picture #_____

picture to main text	5	4	3	2	1	
picture to caption	5	4	3	2	1	CN/P
caption to main text	5	4	3	2	1	CN/P